Committee 18

Fistulas in the Developing World

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CONTENTS

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BACKGROUND

Obstetric fistulas destroy the lives of many young women in the developing world. While obstetric vesicovaginal fistulas have vanished from the industrialized world, despite the efforts of many charitable organizations, they continue to occur in epidemic numbers in developing countries. The national and local governments of these countries do not have either the resources or the political will to address this problem and help these outcast women. The number of vesicovaginal fistulas in a region reflects the quality and the level of perinatal care delivered by the local health systems. In regions where health care (particularly maternal health care) is poor or absent, the number of obstetric fistulas is likely to be high. Although the treatment of women with obstetric fistulas is a worthy endeavour, the ultimate goal should be to eliminate fistulas entirely by providing adequate maternal health services and perinatal care. As some Africans say: 'Treating obstetric fistulas is like taking a serpent by the tail—you can only control the snake by taking it by the head." The ultimate goal must be fistula prevention.

Only rough estimates can be given on the incidence and prevalence of fistulas and reliable data on cure rates and surgical complications are available only from a few authors. There is no internationally-accepted classification system for fistulas and the development of such a system has been hampered by the absence of prospective clinical research that could establish a relationship between fistula classification and surgical outcome.

LITERATURE SEARCHING STRATEGY

From the standpoint of evidence-based medicine, the literature on fistulas is disappointing. A total of 515 articles were identified using search engines such as Pubmed and Sumsearch, of which 149 were published during the last 5 years. Out of this literature, only 8 trials could be identified involving fistulas. Most of the published articles were simple observational studies. There are no evidence-based guidelines or well-designed randomized controlled trials. The major large-scale literature review is the last report of this committee [1].

Data are scarce on health economic issues as well. While there has been a gradual improvement in the number and quality of papers published on obstetric fistulas in the developing world over the last few years, none of these papers rises higher than "level 3" evidence. There is still a generalized lack of reliable data on obstetric fistulas. If the fistula problem is to be tackled successfully, this must change. The academic communities of both the industrialized and the developing worlds must work together to change this situation, thereby improving both maternal health care and the quality of services provided to women with obstetric fistulas.

I. AETIOLOGY AND EPIDEMIOLOGY OF VAGINAL FISTULAS IN THE DEVELOPING WORLD

A fistula is an abnormal communication between the vagina and the bladder (or rectum) of a woman that results in a constant leakage of urine and/or faeces. Most commonly fistulas develop as a result of obstetric trauma, hence the term "obstetric fistulas." Obstetric fistulas have emerged as an international public health problem which is attracting increasing international attention [2, 3]. The aetiology and epidemiology of obstetric fistulas is reviewed in this section, along with the physical, psychological and social consequences suffered by those affected. This summary is based on recent literature reviews on the subject.

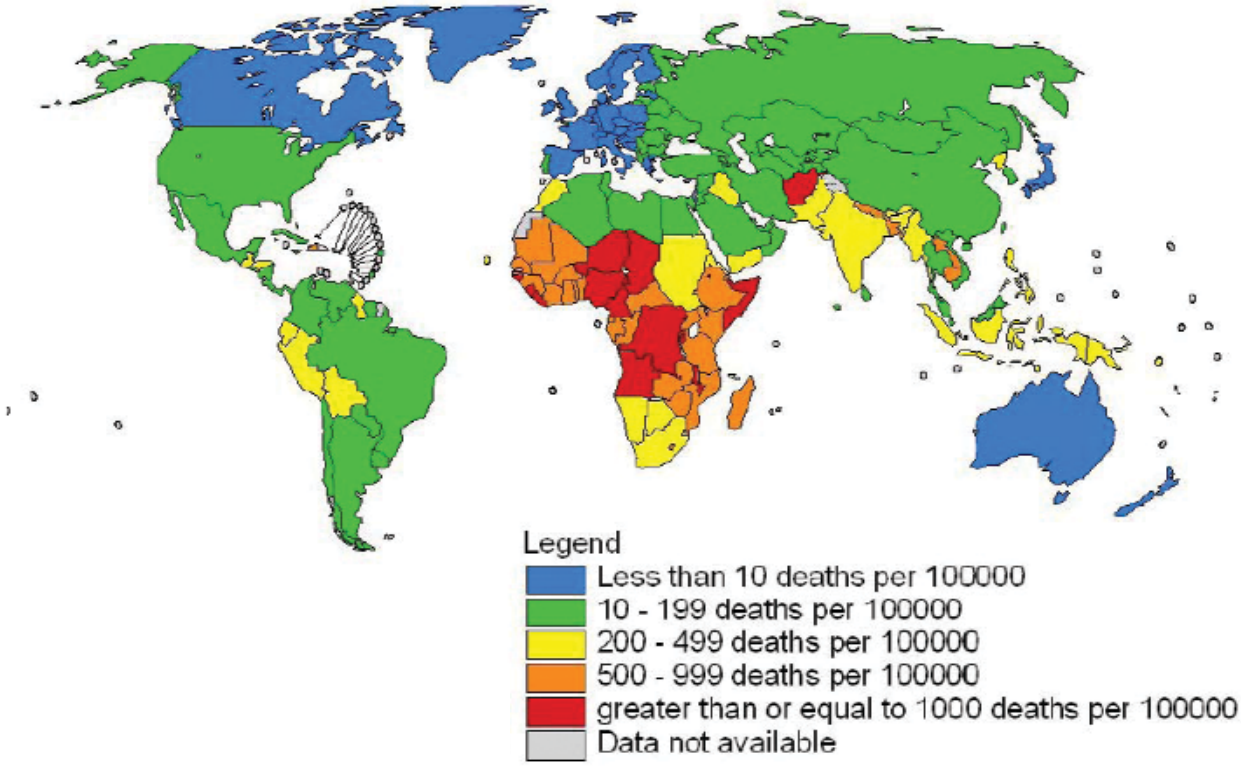
1. GEOGRAPHICAL DISTRIBUTION OF OBSTETRIC FISTULAS

Today, obstetric fistulas have vanished from the developed world and occur almost exclusively in the non-industrialized countries of Africa and Asia, where access to quality medical care is lacking for many (perhaps most) women. The disappearance of this condition from the developed countries is largely the result of universal access to emergency obstetric care. As will be seen later in this chapter, it is not possible at present to give a reliable estimate of the total number of obstetric fistulas in the developing world. Perhaps the most useful comparative health statistic in these countries is the maternal mortality ratio, which appears to be a reasonably accurate surrogate marker for obstetric fistulas. Obstetric fistulas are invariably found in regions where maternal mortality is high because both statistics reflect absence of effectively-functioning emergency obstetric services. Recent (2005) maternal mortality estimates by the World Health Organization indicate that there are half a million maternal deaths worldwide each year, and that 99% of those deaths occur in developing countries, with slightly more than half of those deaths occurring in sub-Saharan Africa, followed by South Asia. Maternal mortality in these two regions accounted for 88% of the world's maternal deaths [4] **(Figure 1).**

2. DEVELOPMENT OF AN OBSTETRIC FISTULA

Obstetric fistulas usually develop from prolonged obstructed labour that occurs as the result of feto-maternal disproportion during the course of delivery. The foetal head (or other presenting part) becomes wedged into the pelvis, through which it cannot pass, trapping the woman's soft tissues between two bony plates. This in turn occludes the blood supply to the affected tissues, which then slough away to create the abnormal communication between the vagina and the bladder and/or rectum, leading to a fistula (**figure 2)**. The foeto-maternal disproportion that causes obstructed labour is due either to a small pelvis (particularly in young, teenage primiparas who have become pregnant before they have reached their full adult pelvic growth), reduced pelvic proportions due to disease or injury, an abnormal foetal presentation (transverse lie, shoulder, breech, etc), or foetal macrosomia. AbouZahr has estimated that foeto-pelvic disproportion of this kind arises in 0.5% to 6.5% of deliveries [5], but no publications have been found to suggest what proportion of such deliveries actually result in the formation of a fistula. Harrison reported on 22,774 deliveries at the Amhadu Bello University Teaching Hospital in Zara, Nigeria [6]. He reported 70 cases of fistula in this series, giving a ratio of one fistula per 288 deliveries. In cases of obstructed labour, preventing the formation of a fistula depends on timely access to emergency caesarean delivery. In the needs-assessment carried out in 20 countries as part of UNFPA's Campaign to End Fistula, caesarean section rate ranged from 0.1% to 3% [7], well below the absolute minimum rate of 5% recommended by WHO to meet maternal health needs. An analysis of data from Demographic and Health Surveys (DHS) has demonstrated that access to caesarean delivery is directly linked to the poverty level based on household goods, the poor having substantially less access to care than do the rich. Using DHS data, Ronsmans and colleagues [8]have shown substantial differences in caesarean rates between urban and rural areas. Not surprisingly women living in rural areas have less access to caesarean delivery than women who live in urban areas [9]. Additional factors including cultural beliefs, perceptions of disease severity, transportation issues, and restrictions on women's social mobility may also reduce the access to caesarean section and other emergency obstetric services [10,11]. Thaddeus and Maine have suggested that there are three "stages of delay" which interact to produce maternal death and serious maternal morbidity: 1) the delay in deciding to seek care; 2). delay in arriving at a health care facility, and 3) delay in receiving adequate care at that facility [12]. The cultural and biological elements that lead to obstetric fistula formation are summarized in **figure 3** [3].

A **second cause** of fistula formation is iatrogenic injury sustained during the course of delivery such as at the time of laparotomy, caesarean section, or through the use of forceps. In many cases the relationship between the intervention and the fistula cannot be determined. Many fistulas develop in women who, after labouring for several days in a remote village, finally present for care at a medical facility. There the woman undergoes a very difficult caesarean delivery, often performed under less-than-ideal circumstances, with delivery of a stillborn baby and subsequent development of a fistula. There are many cases of this type reported in the literature [13-18]. In some cases the fistula is the result of direct injury



(WHO, Used with permission)

Figure 1 : Maternal mortality map 2005

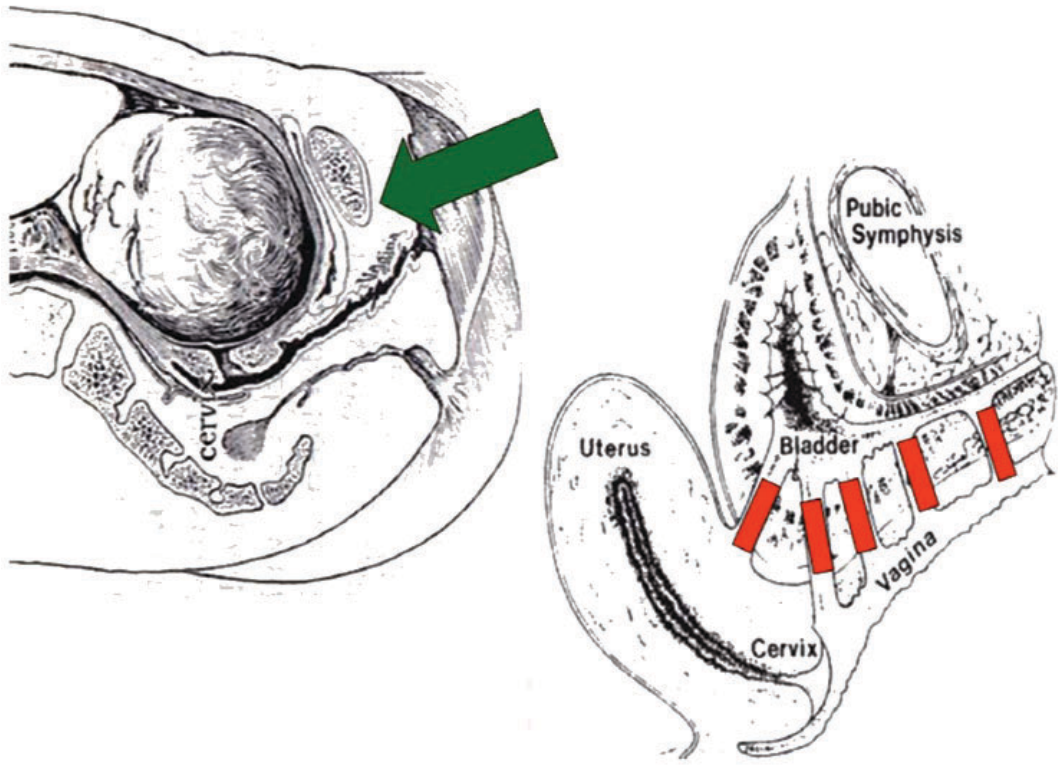


Figure 2 : The foetal head is forced into the pelvis, trapping the bladder, urethra, and other soft tissues between the foetal head and the pelvic bones. This unrelenting pressure leads first to tissue ischemia and the to tissue necrosis with fistula formation. In most cases the bladder will not have been emptied as suggested by this picture, but will be markedly overdistended. The progressive thinning of the bladder wall from overdistention increases the likelihood of ischemic injury. The level at which labour becomes obstructed is directly related to the level at which the fistula occurs, as shown in the drawing on the right. (adapted from Elkins 1994)

under these difficult circumstances; in other cases the tissues involved were already avascular from obstructed labour. There is no doubt that a proportion of fistulas developing in these circumstances will be dependent on the qualifications of the persons performing the obstetric intervention and the nature of the facility where delivery takes place, but there are few data which would allow an accurate analysis of the proportion of fistulas that are the result of surgical misadventure. Because of the lack of trained gynaecologists and general surgeons in Africa, general medical doctors, nurses and midwives have been trained to perform caesarean sections in some areas, and some success has been reported with these programs [19-22]. The long-term success of such programs is uncertain and maintenance of adequate quality of care will depend upon close and continuing supervision of such programs by trained surgeons. This is an area that requires further study.

A **third group** of factors causing fistulas includes accidents, sexual abuse and rape [23]. A recent review on the subject of traumatic fistulas caused by violence against women documents the presence of such cases in war-torn areas of Africa such as the Democratic Republic of Congo, Sierra Leon, Sudan, and Somalia [24]. However, the prevalence of traumatic fistulas in these areas is sometimes difficult to determine with accuracy as the authors report that many women with fistulas claim a history of sexual abuse even when this does not appear to be the case. Two articles published in the Congo Medical Journal and included in the Acquire Project review demonstrate the importance of fistulas resulting from sexual violence [24]. The study by Kalume et al revealed that 17 of the 100 female victims of sexual violence developed a fistula as a result of their injuries [25]. At the Maternity Hospital in Kindu, 36 of the 2010 female victims of sexual violence developed a fistula as the result of sexual assault (28 vesicovaginal fistulas, 2 rectovaginal fistulas and 6 combinations of both fistula types) [26]. In a study in Ethiopia, Muleta et al [27] reported on 91 girls and women with fistulas resulting from sexual violence. A study in Kenya, Nduati and Muita [28] identified two cases of fistula (one rectovaginal, one vesicovaginal) among 21 sexual abused children. These data demonstrate both the variability in the prevalence of post-violence fistulas as well as the importance of this problem in war-torn parts of Africa. More detailed studies are needed in this area.

The **last group** of causes involved in fistula formation includes traditional cutting practices based on erroneous assumptions of disease aetiology or other cultural values. In northern Nigeria, a harmful practice called *gishiri*-cutting accounts for between 2-13% of vesicovaginal fistulas. *Gishiri* is the Hausa word for "salt." It also refers to a disease state in the Hausa ethnomedical system. The belief exists that ingestion of too much salt, sugar or similar substances (especially during pregnancy) will result in the vagina becoming "encrusted," narrowed, or "covered with a filmy membrane" that will prevent the child from being born. When this condition is diagnosed (obstructed labour) a traditional healer (barber, midwife) is consulted who makes a series of *gishiri* cuts in the vagina to "relieve" this obstruction. This often results in direct trauma to the urethra or bladder, causing a fistula.

The cut is usually made on the anterior vaginal wall. Repeated cutting over a period of time may extend the incision area to the posterior vaginal wall. Wall et al [29]) identified among 932 cases of fistula 21 (2.3%) that might be caused by this practice. Tahzib found that *gishiri*-cutting was carried out in 12 of the 80 children (15%) with fistulas [30] and in 13% of the 1443 fistula patients treated at the University Hospital Ahmadu Bello between 1969 and 1980 [31].

Severe forms of female genital cutting such as like infibulations are often said to be possible contributors to the development of fistulas although there is little evidence in the world literature to support this belief. Direct injury to the urinary tract can, of course, occur at the time of "deinfibulation" or anterior episiotomy at the time of delivery (Andrew Browning, personal communication). There is evidence that women who have been subjected to female genital cutting have worse obstetric outcomes than women who have not had these procedures done. A recent study by the World Health Organization looking at the relationship between female genital cutting and obstetric outcome found that "deliveries to women who have undergone FGM are significantly more likely to be complicated by caesarean section, postpartum haemorrhage, episiotomy, extended maternal hospital stay, resuscitation of the infant, and inpatient perinatal death, than deliveries to women who have not had FGM "[32]. The authors were unable to describe any clear mechanism to explain these findings, and the study was not able to look at long-term obstetric outcomes, including fistula formation. If genital cutting practices predispose women to fistulas, the most likely explanations would be direct injury to the genitourinary system at the time of the procedure as already noted, or scarring at the vaginal outlet that leads to prolonged labour. Since most cases of obstructed labour occur higher up in the pelvis than at the outlet, it seems unlikely that female genital cutting by itself is the sole cause of the obstruction that leads to a fistula. One study from Sweden—a highly industrialized country—compared the duration of the second stage of labour in "circumcised" immigrant and "noncircumcised" nulliparous women and found that those who had undergone female genital cutting actually had a shorter second stage than those who had not been "circumcised." The authors concluded that prolonged labour does not seem to be associated with female genital cutting in an affluent society with high standards

of obstetric care [33]. Similarly, an unpublished series of 2000 patients from Ethiopia compared those with and without female genital mutilation. There was no difference between the groups with respect to classification of fistula, length of labour, parity, age and outcomes implying that female genital cutting has little or no influence on the development of obstetric fistulas (A Browning, personal communication).

3. EPIDEMIOLOGY OF FISTULAS

a) Availability and quality of data

Two major shortcomings are present in the published papers on obstetric fistulas. The first is the overall paucity of reliable data on obstetric fistulas. The second is the fact that almost all studies have been done in a hospitals where fistula repair is carried out. Such studies are subject to considerable selection bias and do not provide reliable estimates of the true incidence of fistulas worldwide [34, 35].

b) Indicators for monitoring programs in the struggle against fistulas

In 2006 the WHO proposed indicators for monitoring and evaluating fistula treatment and prevention programs (**table 1),** [36, 37]. These indicators can be subdivided in four groups: epidemiologic indicators, service delivery indicators, training indicators, and markers of the quality of care provided. There is very little information on programmatic indicators of success in the social reintegration of fistula patients [38].

c) Population-based incidence and prevalence of fistulas

A review of the recent epidemiologic literature by Stanton et al [34] has demonstrated that our knowledge of the incidence (new cases) and prevalence (already-existing cases) of obstetric fistula is based on poor quality data. These authors organized the existing population-based estimates of obstetric fistula into three categories. The **first category** consisted of estimates reported in the scientific literature that did not specify the methods used to obtain the estimate. The most commonly quoted number was 2 million cases of obstetric fistula worldwide, with 50,000 to 100,000 new cases each year. The **second group** of estimates is those made by surgeons, again with no methodology clearly specified. Examples include estimates of fistula prevalence in northern Nigeria, the number of new cases each year in Ethiopia and Tanzania, the proportion of pregnant women with fistulas in Pakistan or other developing countries, and the proportion of married women with fistulas seen in Bangladesh. Although interesting, these estimates have low reliability when applied across national populations. The **third group** of estimates is those originating in population-based surveys where there is an adequate description of the methods used to obtain the estimates. Only four such papers could be

Table 1. Proposed indicators for monitoring and evaluating fistula prevention and treatment WHO, 2006 [115].

Epidemiologic
• Prevalence: the estimated number of women living with obstetric fistulas
• Incidence: the estimated number of news cases of obstetric fistulas per year
• Estimated rate of obstetric fistulas per 1000 deliveries
• Number of women treated for obstetric fistula per year
• Estimate of unmet need for fistula repair
Service delivery
• Number of midwives, nurses, and physicians with midwifery skills per 1000 births
• Number of physicians or midlevel providers able to perform a caesarean delivery per 1000 births
• Proportion of births managed with a partograph
• Number of facilities providing simple fistula treatment services
• Number of centres providing specialist fistula services
• Number of fistula treatment services which include social reintegration activities
• Number of surgeons able to undertake simple repairs
• Number of surgeons able to undertake complex repairs **Training**
• Number of training facilities (pre-service and in-service including obstetric fistula prevention and treatment as part of the core syllabus
• Number of surgeons who undergo simple fistula repair training per year
• Number of in country surgeons who undergo specialist fistula training (either in country or elsewhere) per year
Quality of care
• Proportion of women who have a successful first repair at each facility. Ideally, the closure rate should be 85%, with continence achieved in 90% of women with a closed fistula (this success rate can also be disaggregated into different types of fistulas)
• Proportion of women who have had 2 or more unsuccessful repairs
• Percentage of women successfully reintegrated in their community following treatment

identified. The estimates were based on a cohort of pregnant women in western Africa, interviews of women concerning loss of urine or faeces one month after delivery in Bangladesh, model-based estimates of regional and age-specific fistula prevalence and incidence, and the lifetime prevalence of obstetric fistula from the 2005 Demographic and Health Survey (DHS) in Malawi. The cohort study of pregnant women identified only 2 fistula cases. Based solely on these 2 cases, the authors of this study reported an estimated incidence of 10.3 cases of obstetric fistula per 100,000 deliveries. The sample size of this study was clearly inadequate to generate meaningful estimates. In the study of post-partum incontinence in Bangladesh, all 3 women who responded "Yes" to the question on urinary/faecal leakage were examined by a female physician and none were found to have a fistula [34]. In 2007, Muleta and co-workers [39] found a prevalence of 1.5 non-treated fistulas per 1,000 women of reproductive age, based on interviews with 26,819 such women in Ethiopia. Since these reports of urinary and/or faecal incontinence were not confirmed by physical examination, these data are unreliable as incontinence may be due to factors other than a fistula.

The literature review by Stanton et al. suggests only 2 estimates of fistula incidence and 2 of fistula prevalence adequately describe the methods by which these estimates were obtained. These estimates vary from an empirical estimate of 124 obstetric fistulas per 100,000 deliveries for rural sub-Saharan Africa reported by Vangeenderhuysen et al [40] to a model-based estimate of 18.8 fistulas per 100,000 women of reproductive age for all of sub-Saharan Africa reported by AbouZahr [5]. This latter estimate was only for rectovaginal fistulas and did not include vesicovaginal fistulas, which are more common than rectovaginal fistulas in all reported case series of obstetric fistulas. AbouZahr also estimated the global prevalence of obstetric rectovaginal fistulas at 654,000 cases in 1990, with 262,000 of these in sub-Saharan Africa. The only empirical estimate of the lifetime prevalence of obstetric fistula is the DHS estimate from Malawi [41], which suggested that 1 in 20 women of reproductive age were affected. The authors recommend the usefulness of the figures from the model-based estimate even when those date from 1990 because they result from a well-defined method based on the complete literature review and taking into account the age and the causes of women's death [34]. None of these data are very convincing.

d) The estimated number of obstetric fistulas per 1000 deliveries

The estimated number of obstetric fistulas per 1,000 deliveries is a way of attempting to assess a woman's risk of developing a fistula after any given delivery. Danso et al have reported the evolving trends in the number of cases of obstetric fistula per 1000 deliveries at Komfo Ankoye Teaching Hospital in Ghana, calculated over 5-year periods from 1977 to 2004. [42]. This indicator ranged from 0.78 for the years 1977-1981 to 0.66 for the years 2002-2004 and peaked between 1987-1991 at 1.46.

e) The number of women treated for obstetric fistulas per year

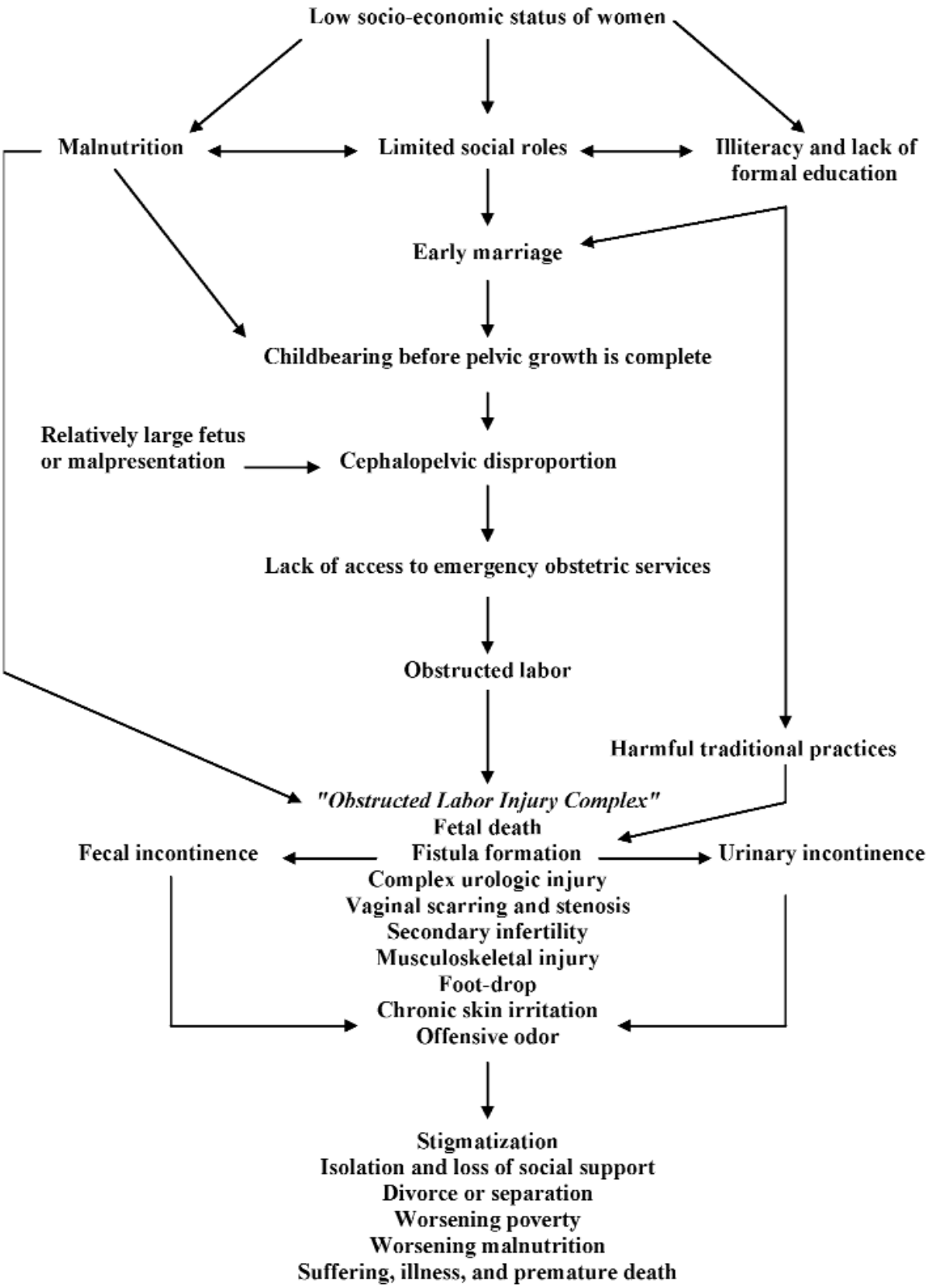
The number of women treated for obstetric fistulas per year is an indicator that takes into account the capacity of the health system to care for women with fistulas. **Figure 4** demonstrates the impact of the presence of external funding to pay for the treatment of fistula patients in a rehabilitation centre in Nigeria between 1999 and 2006 [43]. Initially (1999-2002) this project (FORWARD) was funded by the UK Department of International Development. From 2003 onwards the project was funded by donations and by the government. The dependence on external funding is clearly shown by drop in cases treated when financial support was withdrawn.

f) Unmet need

This indicator takes into account the number of patients needing treatment who cannot get care. This would be the most useful information for policymakers to use in strategic planning, but this requires accurate information on the total number of fistula cases that exist in any given area. These data simply do not exist.

4. FACTORS PREDISPOSING TO THE DEVELOPMENT OF FISTULAS

A woman's obstetric history is the most salient element in the development of an obstetric fistula. It is often stated that fistula patients tend to be young women with small, immature pelves (most commonly primiparas), with an antecedent history of obstructed labour, prolonged delay in receiving emergency obstetric are, sometimes having undergone late caesarean delivery [44-51]. Creanga and Genardy [35] analysed the role of 5 socio-medical factors in the development of fistulas: age, parity, duration of labour, the place of delivery, and whether the delivery was attended by a qualified person along with the proportion of caesarean sections. The authors identified only 5 studies that included data on all these 5 factors, 7 other studies that reported data on 4 of these factors, and an additional 7 that reported data on only 3 of these factors. We have updated their work by including articles published in 2007 that reported data on these 5 socio-medical factors [52, 53]. The results of this enhanced review are presented in **table 2**. The proportions of young women, primiparas and caesarean deliveries are higher than in the general population. Moreover, the duration of labour in these cases is greater than 2 days, strongly suggesting that fistulas develop most commonly in young women with obstructed labour. Such predisposing factors were confirmed in a case-control study from Gombe Hospital



(Worldwide Fistula Fund, used by permission)

Figure 3 : The obstetric fistula pathway

Figure 4 : Evolution of the number of fistula patients receiving treatment Residential Centre of Dambatta, Nigeria [43]

Table 2. Socio-medical risk factors associated wih obstetric fistulas

Authors (year)	No of cases	Obstetric causes,%	Mean age, years (patients younger than 16, 18 or 20 years, %)	Mean, duration of labor, days	Primiparas (mean parity) %	Place of delivery, %	Cesarean delivery, %
Hilton and Ward (1998)	2484	92.2	28.0 (13.0<16, 32.0<20)	2.5	31.4 (3.5)	Home, 27.0 Hospital, 73.0	34.0
Tahzib (1983)	1443	83.8	21.0 (32 .9<16, 54.8<20)	3.0	52.0 (1.6)	Home, 64.4 Hospital, 35.6	6.7
Wall et al (2004)	932	96.5	27.0	2.4	45.8	Home, 23.5 Hospital, 76,5	40.3
Kelly and Kwast (1993)	309	97.4	22.4 (7.0<16, 42.0<20)	3.9	62.7	Home, alone or with an unskilled attendant, 60.8	7.3
Ibrahim et al. (2000)	31	100.0	(60.0, 13-15) 90,0 < 18)	4.0	81.0	Home, 16.0 Hospital, 84.0	13.0
Rijken and Chilopora (2007)	407	92.3	22.8 (32.8<20)		49.8		36.4
Nafiou et al (2007)	111	100	22.5 (25.0<20)	3.0	44.0	Home, 35.1 en route, 5.4 Hospital, 59.5	21.0

Adapted from Creanga and Genadry, 2007 and completed with two new references

in Nigeria which compared 80 women with fistulas to 80 inpatients without fistulas who were recruited randomly as a control group. Major risk factors for the development of a fistula included early age at first marriage (average 14 years), short stature (average height of 146.2 cm), illiteracy, rural residence and living at more than 3.0 km from the nearest health care facility [54].

5. PHYSICAL, SOCIAL AND PSYCHOLOGICAL CONSEQUENCES

Recent publications [29, 55-61] and a review by Ahmed and Holtz [62] have documented the physical, social, economic, emotional and psychological consequences of fistulas in affected women. A meta-analysis of the literature published between 1985 and 2005 showed that 36% (95% CI: 27%-46%) of women afflicted with fistulas were divorced or separated and foetal loss occurred in 85% of cases in which a fistula developed.

Low self-esteem, feelings of rejection, depression, stress, anxiety, loss of libido and loss of sexual pleasure were commonly reported by these women. It also appears that the rates of separation or divorce increases the longer a woman lives with a fistula, particularly if she remains childless [63]. Not surprisingly, successful fistula repair reduces the prevalence of these psychosocial pathologies [62].

Three recent articles further document the presence of these problems in women with fistulas. In their 2007 article on the health and social problems of women with fistulas in Ethiopia, Muleta et al [39] reported 69.2% of fistula victims were divorced, only 19.2% were members of a local community association, and 44.2% ate separately from other family members. Forty-eight of 52 women felt listless and 28 had suicidal thoughts. Goh et al [56] conducted a prospective observational study to screen women in Bangladesh and Ethiopia with fistulas for mental health dysfunction.

Of the 68 women with fistulas screened, 66 were at risk for mental dysfunction as measured by the General Health Questionnaire (GHQ-28) compared with only 9 of 28 controls. In a prospective interventional study, 51 women with fistulas in the north of Ethiopia were screened for mental health issues before and 2 weeks after surgery using the GHQ-28.

Prior to surgery, all women had signs of mental dysfunction, but two weeks after fistula surgery, only 36% still had signs of mental distress. Among the 45 women who were cured of their incontinence, only 27% had signs of mental dysfunction two weeks after surgery, whereas all of the six patients who remained incontinent continued to screen positive for mental distress on the GHQ-28 [55]. These studies highlight the importance of attending to mental health issues among women who have sustained an obstetric fistula.

II. DIAGNOSIS

1. SIGNS AND SYMPTOMS

Obstetric fistulas may develop early, either after vaginal delivery or after an emergency caesarean section. Even though these women may be under medical supervision, these early fistulas may not be detected by the local staff. Many of these women leave the hospital without a baby but with a fistula [64]. Once the fistula is established, the continuous leakage of urine will lead to a foul odour, skin deterioration, and a cascade of hygienic and social problems. In most cases these women will be poor. Women may present early or late after a fistula appears.

2. CLINICAL EVALUATION

A fistula patient often has more than just a fistula. When examining and treating a woman in whom a fistula is suspected, the clinician should look for evidence of the entire 'obstetric labour injury complex' [65]. Clinical evaluation should include the assessment not only of urologic and gynaecologic injury, but also for evidence of the presence of rectovaginal fistulas, orthopaedic trauma, neurologic and dermatologic injury as well. The psychological impact of the fistula should never be underestimated. **(table 3)**

After admission, fistula patients should undergo a thorough evaluation through the taking of a detailed history, general physical examination as well as a careful pelvic examination. The site of the fistula, the condition of the surrounding tissues, and the feasibility of a vaginal surgical approach should all be assessed. In many countries the absence of advanced technology will mean that careful clinical examination will be the only tool available to the surgeon in planning a repair.

a) Urologic injury

1. Bladder

The loss of bladder tissue from pelvic ischemia during obstructed labour affects both the technique needed for, as well as the functional outcome of, fistula repair. Loss of bladder tissue is one of the main reasons why obstetric fistula repair is technically difficult. The surgeon must try to close large defects in the bladder often with only small remnants of residual bladder tissue with which to work. Although there are as yet no basic histological studies of the tissue surrounding obstetric fistulas, it seems clear that these tissues have themselves sustained significant damage during obstructed labour. The fistula itself develops in an area which becomes necrotic; but the tissues surrounding the fistula have also suffered varying degrees of ischemia. In some cases pressure necrosis may destroy virtually the entire bladder, so that if the defect can be closed at all, the afflicted woman is left with a remarkably small (30 - 50 ml) bladder that

Table 3. The obstructed labour injury complex

Urological
Vesico-vaginal fistula
Urethro-vaginal fistula
Uretero-vaginal fistula
Utero-vesical fistula
Combined fistula
Urethral damage or loss
Stress incontinence
Decreased bladder compliance
Hydro-ureteronephrosis
Renal failure
Chronic pyelonephritis
Gynaecological
Amenorrhea
Vaginal scarring and stenosis
Cervical damage
Pelvic inflammatory disease
Infertility
Gastro-intestinal
Recto-vaginal fistula
Acquired rectal stenosis
Anal sphincter incompetence
Musculoskeletal
Osteitis pubis
Neurological
Foot-drop
Neurogenic bladder
Dermatological
Excoriation of the skin
Foetal
95% foetal death
Social
Social isolation
Divorce
Poverty
Malnutrition
Depression

remains virtually functionless. Because most of the innervation of the bladder runs through the base and trigone, ischemic injury to these areas probably also produces an element of neuropathic bladder dysfunction. Basic scientific studies confirming this hypothesis have yet to be undertaken.

Clinically it will be important to assess the **number and size of the fistulas**, their location, the amount of fibrosis present, and any involvement of the ureters and or the urethra.

Clinical experience also suggests that **bladder compliance** may be altered by the extensive fibrotic changes that often take place. To date there have been few urodynamic studies reported on patients who have undergone successful fistula closure [66, 67]. In the former study bladder compliance was not measured. In the latter study by Carey et al., of 22 women with severe urinary incontinence after fistula closure, 9 had urodynamic stress incontinence with normal bladder compliance, 3 had urodynamic stress incontinence with poor bladder compliance, 9 had mixed incontinence, and one had voiding difficulty with incomplete bladder emptying and overflow. There is a great need for further investigation of these issues; unfortunately, those hospitals most likely to see large numbers of patients with obstetric fistulas also usually lack the resources for more advanced urologic investigation.

A number of patients with vesicovaginal fistulas develop **vesical calculi** [68, 69]. Often these bladder stones develop in association with a foreign body in the vagina. In some cases a foreign body may have been the original cause of the fistula (such as an object used for masturbation or a container filled with traditional herbal medicines, placed in the vagina for an ostensibly therapeutic purpose). In other cases, the stone may form in association with an object that was placed into the vagina in an attempt to plug the fistula and prevent urine loss, which subsequently became stuck, eventually became calcified, and ultimately increased the overall misery of the afflicted woman. In other cases, no foreign body can be found. Frequently in these cases it is the increasing pain associated with stone formation that causes the suffering patient to present for care. In fistula cases complicated by the presence of vesical calculi, the stone is often located supratrigonally and the bladder may be able to hold at least a small amount of urine in the vicinity of the calculus (which allows for its continued growth) [69].

Removal of the stone (usually at a separate operation) is a prerequisite for successful fistula closure in such cases. After stone removal, the bladder should be allowed to heal prior to attempted fistula closure. If this is not done, there is substantial risk of post-operative infection and breakdown of the repair.

2. Urethra

The ischemic changes produced by obstructed labour often have a devastating impact on urethral function. Complete urethral loss occurs in about 5% of fistula patients, with about 30% of fistula patients sustaining partial urethral injury. Goh et al. found that up to 63% of fistula patient have sustained some injury to the urethra [70]. The great Egyptian fistula surgeon Naguib Mahfouz was well aware of this problem [71].

Mahfouz stated [71] that fistulas “in which the whole urethra has sloughed” are “the most troublesome of

all." The experience of subsequent surgeons seems to bear this out. In a 1980 series of 1,789 fistula patients, Sister Ann Ward reported that only 26 cases were inoperable; but in all 26 urethral loss was present [72]. There are no comparative surgical studies that evaluate differing techniques of urethral reconstruction in patients with obstetric fistulas. There are no data on post-operative urethral function. Work of this kind is badly needed.

3. Ureters

Ureterovaginal fistulas from direct injury to the distal ureter during obstructed labour are uncommon, comprising only about 1% of fistula cases. Depending on the amount of tissue that is lost at the bladder base, the ureteral orifices can be found in bizarre locations, ranging from the lateral vaginal walls all the way up to the level of the vesico-urethral junction and the pubic arch (**Figure 5**).

Aberrant ureteral locations of this kind can easily be missed on clinical examination and are one cause of persistent incontinence after otherwise "successful" fistula closure. Standard urological tools such as ureteral stents are usually not always available in hospitals in the developing world, and most of the surgeons who work in such hospitals are not trained in "urologic" techniques such as ureteral reimplantation [73].

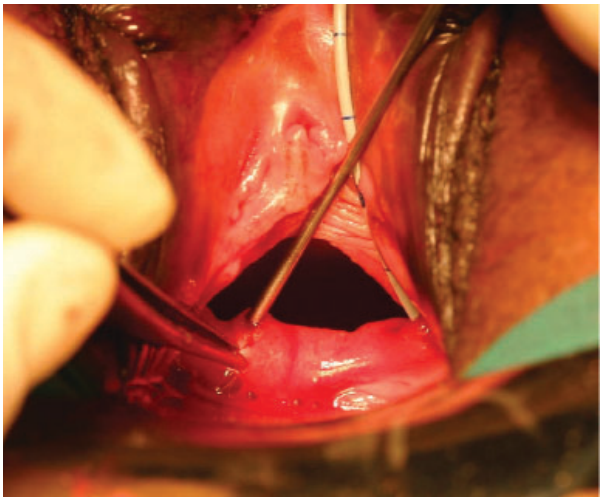


Figure 5 : Complex fistula with intravaginal ureters

4. Kidneys

The incidence of secondary injury to the upper urinary tract in fistula patients has received little study, but this phenomenon appears to be clinically important. Clinical experience suggests that renal failure is a common cause of death in women with obstetric fistulas.

Upper tract damage could result from chronic ascending infection, obstruction from distal ureteral scarring, or even from reflux in very young patients. Lagundoye et al [74] found that 49% of fistula patients had some abnormality of the kidneys when intravenous urograms were performed. Most of the pathology that was detected consisted of minor calyceal blunting, but 34% of patients had hydro-ureter, 9.7% had ureteral deviation, four patients had bladder stones, and 10 patients had a non-functioning kidney. More research is needed in this field. Iatrogenic causes of hydronephrosis and renal insufficiency may also exist. Injury of the ureters during the surgery or scarring in the post-operative phase might play a role, but data to support this are currently missing.

b) Gynecologic injury

1. Vagina

An impaction of the foetal head serious enough to cause ischemic injury to the bladder will also cause ischemic injury to the vagina, which is likewise trapped between the two bony surfaces. These injured areas heal with varying degrees of scarring. A small sonographic study by Adetiloye and Dare [75] detected fibrotic changes in 32% of fistula patients and minor vaginal wall fibrosis in another 36%. Vaginal injuries in fistula patients exist along a spectrum that includes only small focal bands of scar tissue on one end all the way to virtual obliteration of the vaginal cavity on the other. Roughly 30% of fistula patients require some form of vaginoplasty at the time of fistula repair. The degree of vaginal injury has several important implications. In the first instance, severe vaginal injury results in loss of substantial portions of the vagina. In many instances the scarring is such that vaginal intercourse is simply not possible. There is very little information available on the sexual functioning of fistula patients, yet this is obviously an important concern in healthy marital relationships and undoubtedly contributes to the high rates of separation and divorce that appear common among these women. Browning et al. noted that among 240 fistula patients only 7.1% were having sexual intercourse prior to surgery and of those who were sexually active, 17.6% had dyspareunia. Six months after surgery 35% of patients were sexually active. Of those, 10.0% had dyspareunia. The main reasons for lack of sexual relations were divorce, anxiety about damaging the repair, widowhood or a scarred vagina [63].

Surgical repair of fistulas in women with extensive vaginal scarring often requires the use of flaps and tissue grafts in order to close the fistula. Little work has been done to assess whether or not sexual function normalizes in women who have had such operations. The presence of scarring that requires the use of plastic surgical techniques of this kind markedly reduces the effectiveness of surgical repair when fistula closure is attempted by surgeons who lack experience in reconstructive gynaecologic surgery. Although several papers have described various techniques for vaginoplasty that may be required in fistula patients [76-78], there is a pressing need to

investigate the role of vaginal plastic surgery at the time of fistula repair and to evaluate subsequent sexual functioning in patients who require surgery of this kind [79].

Vaginal scarring impacts on more than just sexual functioning. The presence of vaginal scarring appears to be an important prognostic factor in determining the likelihood both of successful fistula closure, and also for the development of debilitating urinary stress incontinence after otherwise successful fistula repair. In one unpublished series of 26 fistula patients with severe vaginal scarring, 57.7 percent suffered from stress incontinence after fistula repair and 23.5 percent had a persistent or recurrent fistula. This would compare to an expected stress incontinence rate of around 26% and a failed fistula closure rate of about 7% in the overall population of fistula patients (Arrowsmith, personal communication). Kelly and Kwast have also reported worsening surgical outcome in fistula patients who have vaginal scarring than in those without such findings [80].

2. Cervix, Uterus, and Future Reproductive Performance

From an obstetric point of view, timely termination of obstructed labour requires operative intervention, most often by caesarean delivery. When timely access to caesarean section is not available, prolonged obstructed labour results in a high rate of **uterine rupture**, usually with catastrophic consequences for both mother and child. For example, Ekele and co-workers reported one uterine rupture for every 79 deliveries in Sokoto, Nigeria, an impoverished rural area with poor obstetric services [81]. Caesarean delivery in such cases is often lifesaving, but in some cases it may also be implicated in the formation of a vesico-uterine fistula [82-84]. **Vesico-uterine fistulas** can present in different ways, depending on their location, size, and the degree of patency of the endocervical canal. The least troublesome vesico-uterine fistulas do not result in incontinence, but are characterized by the absence of vaginal menstruation in the presence of cyclic haematuria ("menouria" or "Youssef's syndrome"), whereby the menstrual flow exits exclusively through the urinary tract [85-87]. Other vesico-uterine fistulas may be associated with various combinations of altered menstruation and either periodic or continuous incontinence. The finding most characteristic of an uterovesical fistula is demonstrable loss of urine through the cervix (a finding that also occurs with vesicocervical fistulas). In the absence of operative intervention, uterovesical and vesicocervical fistulas are relatively rare.

Many patients sustain severe **cervical damage** as well as vaginal injury during the course of obstructed labour. It is rare to see a completely normal cervix when examining a fistula patient. In the worst cases, prolonged obstructed labour may result in complete cervical destruction, leaving the patient with no identifiable cervical tissue at all. Unfortunately, detailed descriptions of the condition of the cervix have not been included in the case series of fistulas published to date. Since cervical competence is such an important factor in future reproductive performance, this is yet another clinical area that demands further study. Other studies have shown **amenorrhea** rates from 25% to 44% [88-90]. Many of these patients undoubtedly have hypothalamic or pituitary dysfunction [89]. A follow up study by Browning et al. showed that while the amenorrhea rate was 58% pre-operatively, this rate improved to 29% at 6 months after surgery, suggesting a recovery of ovulation in a proportion of operated women [63]. While the high incidence of amenorrhea in vesicovaginal fistula patients is widely recognized, only one unpublished study has been done to date looking specifically at uterine pathology in the vesicovaginal fistula population. Dosu Ojengbede of the University of Ibadan (personal communication) performed hysteroscopy on fistula patients in Nigeria and found that intrauterine scarring and Asherman's syndrome were common in these women. The combination of widespread amenorrhea, vaginal scarring, and cervical destruction leads to a tremendous problem of **secondary infertility** among these patients. To date, there have been no serious scientific efforts to explore treatment of cervical and uterine damage in vesicovaginal fistula patients.

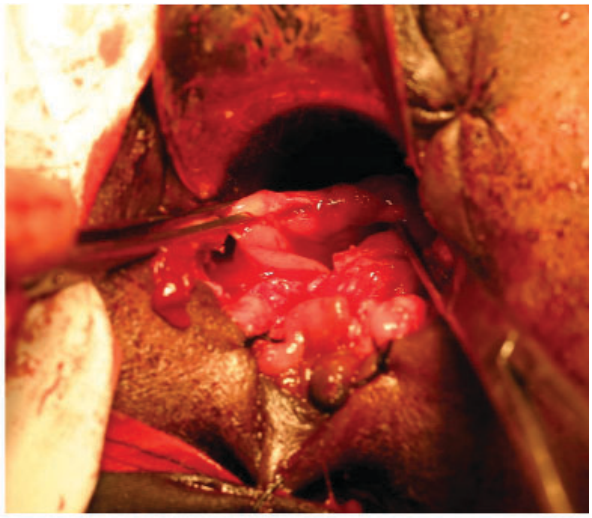
Subsequent reproductive performance of women who have had an obstetric vesicovaginal fistula has been analyzed in a few articles [88, 90-92]. Emembolu analyzed the subsequent reproductive performance of 155 fistula patients delivered at Ahmadu Bello University Teaching Hospital in Zaria, Nigeria, between January 1986 and December, 1990 [92]. This series included pregnancies in 75 women who became pregnant after successful fistula closure and 80 women who became pregnant while still afflicted with an unrepaired fistula that had occurred in a previous pregnancy. The data presented do not allow one to determine the subsequent fertility rates of women who develop a fistula, but clearly indicate that women can, and do, become pregnant after sustaining an obstetric fistula. The proportion of booked pregnancies receiving antenatal care was higher in the repaired group (73%) than in the unrepaired group (51%), and reproductive performance was better (but still dismal) in those patients who had had a fistula repair. Of the 69 patients whose fistulas had been repaired, there was a recurrence of the fistula in 8 (11.6%), and among those undergoing a trial of vaginal delivery, the fistula recurrence rate was nearly 27%. In women with pre-existing, unrepaired fistulas who became pregnant but who did not register for prenatal care in the subsequent pregnancy, maternal mortality and morbidity in those pregnancies was high, reflecting continuation of the conditions that led to fistula formation in the first place [92].

The commonest maternal morbidity, excluding recurrence of vesicovaginal fistulas, was haemorrhage requiring blood transfusion in 35 patients (27.3%). Others included ruptured uterus in 3 unbooked patients whose fistula had not been repaired, bladder injury at caesarean section in 1.6% and acute renal failure in 0.8%. Maternal complications occurred more frequently in the patients whose fistula had not been repaired and who were also unbooked.

The largest series is that of Aimakhu, who analyzed subsequent reproductive performance in 246 women who underwent successful fistula closure at University College Hospital in Ibadan, Nigeria, between 1957 and 1966 [88]. Only 48 patients became pregnant following fistula repair with a total of 65 pregnancies. All but 6 of these were managed at University College Hospital. Five patients aborted prior to the 16th week of gestation, leaving only 60 viable pregnancies. The plan was to perform elective caesarean section on all patients who became pregnant after fistula repair, but only 49 caesarean operations were carried out. The results of the vaginal deliveries were not encouraging. Patients who underwent caesarean delivery fared better. There were 49 babies delivered and 47 survived. There was no recurrent fistula among women previously repaired who became pregnant and had a subsequent caesarean section. There was one maternal death from pulmonary embolism in a woman who underwent an emergency delivery at 32 weeks gestation due to a prolapsed fetal umbilical cord.

c) The rectovaginal fistula

Rectovaginal fistulas appear to be significantly less common than vesicovaginal fistulas. In case series of patients presenting with vesicovaginal fistulas, between 6% and 24% have a combined rectovaginal and vesicovaginal fistula (**Figure 6**) [29-31, 49, 93-102]. In most series, isolated rectovaginal fistulas are less common than combined fistulas. Indeed, most series do not even mention isolated rectovaginal fistulas as a clinical phenomenon. In a series of patients from Turkey reported by Yenen and Babuna [103], 7.1% had rectovaginal fistulas and 6.5% had “combined” fistulas. From the report it is not clear if this latter figure was comprised solely of rectovaginal and vesicovaginal fistulas, or if it included other combinations of urinary tract fistulas as well (vesicocervicovaginal, urethro-vaginal, etc.). Kelly and Kwast [80] reporting data from the Addis Ababa Fistula Hospital, noted a 15.2% pre-valence of combined fistulas, and a 6.8% prevalence of isolated rectovaginal fistulas in that population. Ethiopia appears to have one of the highest rates of rectovaginal fistulas reported in the literature. Whether this relates to specific obstetric characteristics of the Ethiopian population or whether this relates to other social factors — such as the cases of rape and sexual abuse of young Ethiopian girls reported by Muleta and Williams [27] — is unclear.



(by courtesy of A. Browning)

Figure 6 : rectovaginal fistula

Since the pubic symphysis poses an obstruction to delivery through the anterior pelvis, in normal birth mechanics the foetal head is normally forced posteriorly towards the rectum, anus, and perineum at the end of the second stage of labour. In non-obstructed labour, direct laceration of the perineum is not uncommon, occasionally resulting in a complete perineal tear with complete disruption of the anal sphincter. If this is not repaired, a complete perineal tear with sphincter disruption can create a rectovaginal fistula at the anal outlet [104]. This mechanism of fistula formation seems more likely to account for low rectovaginal fistulas, whereas rectovaginal fistulas higher in the pelvis would seem more likely to be caused by direct tissue compression from obstructed labour.

d) Orthopaedic trauma

Ischemic injury from obstructed labour not only affects pelvic organs, but also the pelvis itself. These changes are most pronounced in the pubic symphysis. The normal radiography of the symphysis pubis has been described in detail by Vix and Ryu [105]. In obstructed labour, the pubic bones are often directly involved as they form one side of the bony vice in which the vulnerable soft tissues are trapped. In fistulas where large amounts of bladder tissue are lost, the periosteum of the pubic arch can often be palpated directly through the fistula defect. It is these cases in which ischemic damage to the pubic bones is most likely to be demonstrable. In a study of 312 Nigerian women with obstetric vesicovaginal fistulas Cockshott [106] detected bony abnormalities in plain pelvic radiographs in 32 percent of these patients. The findings included bone resorption, marginal fractures and bone spurs, bony obliteration of the symphysis, and wide (>1 cm) symphyseal separation. Most of these changes appear to be the result of avascular

necrosis of the pubic symphysis. Their long-term significance remains uncertain and further study is required.

e) Neurologic injury

Another tragic injury associated with obstetric fistula formation is footdrop [107]. The relationship between difficult labour and neurological injury has been known for centuries, and the condition was traditionally called "obstetric palsy" [108]. Women with this condition are unable to dorsiflex the foot and therefore walk with a serious limp, dragging their injured foot, and using a stick for support (**Figure 7**). Sinclair's paper on maternal obstetric palsy in South Africa [108], made the comment that "There are no records of this lesion associated with vaginal fistulas, where there has been prolonged pressure by the foetal skull in the lower part of the pelvis." This statement is clearly wrong. In Waaldijk and Elkins' review of 947 fistula patients, nearly 65% of those studied prospectively had evidence of peroneal injury either by history or physical examination [107]. The prevalence of clinical footdrop among patients seen at the Addis Ababa Fistula Hospital is about 20% [65].

Various theories have been proposed for the aetiology of this condition. In general clinical series of peroneal nerve palsy, the most common aetiologies appear to be direct trauma from ankle inversion, fractures of the hip, femur, fibula or tibia; knee injuries, alcoholic neuropathies, and a variety of miscellaneous or idiopathic causes. In obstetric patients the lesion most likely develops from one of three causes: prolapse of an intravertebral disk, pressure from the foetal head on the lumbo-sacral nerve trunk in the pelvis leading to direct compression of the peroneal nerve, or direct trauma to the peroneal nerve from prolonged squatting and pushing in the second stage of labour [108-110]. There is very limited experience with the performance of electromyography on fistula patients. Bademosi and colleagues performed EMG studies on 34 Nigerian women with obstetric neuropraxia at the University of Ibadan and found that 88% of the lesions were due to lumbosacral plexus injury high in the pelvis [111].

Foot-drop from obstructed labour. Due to injury of the lumbosacral nerve plexus and/or the common peroneal nerve, the patient is unable to dorsiflex her foot. (Worldwide Fistula Fund, used by permission)

Figure 7 : Neurological injury

Footdrop has also been associated with trauma sustained in difficult forceps deliveries, particularly mid-pelvic rotations, but again, as others have emphasized "The peripheral nerve lesion following instrumental delivery may have developed in any case and forceps were but incidental or at the most a precipitating factor in border-line cases" (Sinclair 1952). The prognosis for recovery from this injury is unclear, as there are no proper prospective studies of women who have developed this condition. Waaldijk and Elkins suggest that most patients recover some or all of their nerve function spontaneously within two years of the injury [107]; however 13% showed persistent signs of nerve trauma. In some cases the affected women are almost completely crippled from bilateral lesions and suffer tremendously from the additional burden imposed by immobility on someone who already suffers from intractable urinary incontinence.

Physiotherapy and the use of posterior splints improve the condition of some patients. Others may require surgical intervention: the use of posterior tibialis tendon transfer is a well-established procedure for patients with footdrop from other causes (such as leprosy), and it may be that this method will be useful in treating women with unresponsive obstetric palsy as well [112, 113].

f) Dermatologic injury

Skin lesions can be variable, depending on the importance of the leakage, the duration of the leakage and the level of hygiene. The condition of the skin, which is in constant contact with a stream of urine and/or faeces, is one of the most bothersome problems for the fistula patient (**Figure 8**). In some women minimal skin damage will be noted, while in other extreme causes, the vulvar skin might be covered with uric acid crystals and salts or might be superinfected.

g) Psychological injury

The consequences of isolation, divorce etc… have been described in II.5. Depression has a high prevalence in patients with obstetric fistula. Care must be taken to acknowledge these factors. A significant improvement can be expected after successful surgery in many patients.

(SOLFA, used by permission)

Figure 8 : Skin problems

3. EVALUATION WITH ADVANCED TECHNOLOGY

The use of technology beyond simple physical diagnostic techniques in women with fistulas will depend entirely on the local availability of such resources. Cystoscopy, ureteral catheterisation, ultra-sound or radiographic examination and urodynamic testing facilities are not always present. Utilization of modern diagnostic techniques might be especially useful in the evaluation of the upper urinary tract and in developing strategies for long-term follow-up of fistula patients. The ability to obtain some basic or advanced laboratory tests, would also be useful in many cases. At a minimum, it is desirable to have basic haematology and electrolyte testing available, if the data can be trusted. HIV testing is optional.

III. FISTULA PREVENTION

Preventing obstetric fistulas is an enormous task that will depend largely on continuous improvements in the maternal healthcare infrastructure of the countries where fistulas are prevalent. The magnitude of the needs in this part of the world is staggering. Waaldijk has stated that at least 75,000 new obstetric units should be built across Africa to deliver adequate perinatal care and to prevent new cases of fistulas [114].

Historical experience from Western countries suggests that fistula prevention can only be accomplished by providing good antenatal screening and surveillance of ongoing pregnancies, delivery in the presence of trained birth attendants, and prompt access to emergency obstetric services when problems arise during labour. In fistula-prevalent areas, basic emergency obstetric care is usually inaccessible due to problems with transportation and referral centres for advanced care are usually far away for women living in rural areas. A recent survey by UNFPA and UNICEF showed that each African country assessed had only one emergency obstetric unit per 500 000 inhabitants and none had the recommended number of facilities for the provision of basic emergency obstetric care. The unmet obstetrical needs were huge: only 8.2-35% of women with complications during labour received care at an appropriate facility [115]. Even when a woman with a complication arrives at such a facility, the receipt of good care is not guaranteed. In most countries the patient must pay for emergency care, including caesarean section and many families simply cannot afford the cost involved or are left in debt afterwards for many years [116].

In addition to creating centres for emergency obstetric care, adequate training for health care professionals has to be provided, financing mechanisms have to be established and access to these facilities has to be guaranteed for all patients who need these services. This is an enormous task and most governments in the developing world do not have the necessary resources for it (or the political will to carry such projects out). Western aid organizations are often more interested in funding the treatment of women with fistulas than with doing the hard work of constructing primary care obstetric units or funding the provision of emergency obstetric services [117]. What is clear is that perinatal care is grossly inadequate due to the large number of vesicovaginal fistulas that is being reported in many developing countries. It is also clear that there are multiple reasons that young mothers at risk of obstructed labour do not attend medical facilities, most of which have already been described. Even when patients in need arrive at a healthcare facility, they may not receive the care they need. This situation is described eloquently by Sundari in his paper on how health care systems in the developing countries contribute to maternal mortality [11]. The same problems are applicable to the prevention of fistulas. Thaddeus and Maine (1994) have elaborated on the three causes of delay that contribute to maternal mortality. These same causes of delay contribute to obstetric fistula formation once labour becomes obstructed.

1. PATIENT FACTORS

- Delay in arriving at a healthcare facility
- Non-use or non-availability of prenatal care
- Transportation problems
- Financial problems
- Lack of women's authority over decision-making regarding healthcare
- Lack of information about risk factors, health problems, availability of services

2. QUALITY OF CARE FACTORS

- Shortage of trained personnel
- Lack of equipment
- Poor patient management

The lack of decent training is prevalent and is the result of the interaction of many different factors. There is wide high variability in the quality of training and in the curricula at many African universities and teaching hospitals. Once trained, local doctors may experience difficulties in maintaining their skills because of political issues, lack of equipment, and administrative decisions by local health authorities. In many developing countries poor staff training is compounded by the fact that only a 'survival health economy' exists, meaning that elective surgery is usually delayed until an emergency exists. Many pregnant women will have been warned about the risk of obstructed labour and its consequences, but simply do not have the money to undergo elective caesarean section even when it is advisable. Many local doctors depend on private income in order to survive in difficult economic situations. Inappropriate operations may compound the healthcare delivery problems that already exist. In India, where industrialisation is more advanced and the healthcare system is better than that of most African countries, caesarean sections are being misused for profit in the private sector of some of the states [118].

Ideally, therefore, fistula centres should be developed in collaboration with other maternal healthcare initiatives and they should also be prepared to provide services dealing with the entire obstructed labour injury complex and its consequences. A comprehensive approach that combines a curative setting with prevention is being advocated by many [119]. Doing this effectively will require the establishment of incentives at multiple levels throughout the healthcare system.

a) At the level of the patient

- Prenatal care is important because it plugs patients into the healthcare system and helps them access care when emergencies arise.
- "Maternity waiting homes" can be established for women at high risk of obstetric complications [120-123]. They then stay in the vicinity of the hospital until labour begins, at which time they are transferred to the hospital for monitoring and intervention. The success of such programs depends on multiple factors operating at the local level (D. De Ridder, personal observation RD Congo 1987).
- Local radio or television shows involving former fistula patients can help create awareness about these problems and provide social mobilization.
- Young women and men should be educated about the risks of bearing children at too young an age. Changing traditional customs of early marriage will require steady and prolonged pressure over time, but is one of the most important social interventions
- These measures should be incorporated in a wider program that emphasizes education for girls and women. This is an extremely effective means of promoting maternal health [124] [7].

b) Professional level

Local midwifes and doctors should be trained to screen for injuries associated with obstructed labour. It is not uncommon for a patient to undergo an emergency caesarean and to leave hospital later with a vesicovaginal fistula without any of the medical staff being aware of this problem (D. De Ridder, personal observation, Kisantu RD Congo 2007).

Several challenges are present:

- Continuing education on perinatal care
- Screening patients for risk factors
- Adequate and improved technical obstetrical skills
- Appropriate postoperative care
- Early detection of fistula formation
- Staff accountability for the quality of care provided

- Hospital level
- Careful record keeping
- Social accountability

c) Community level

At the community the level, awareness about the availability of antenatal care and the risk of obstetric fistula formation ought to be increased. Some fistula centres note that up to 30% of their patients are being referred by former patients who are now cured. Ways should be explored to use former patients as a mechanism to increase awareness of the problem and to organize prevention strategies, perhaps by monitoring women at the village level to detect prolonged labour early in its course.

Community-wide associations to promote maternal health should be encouraged, linking local farmers' unions, women's organisations, and religious associations, for example.

Patients often depend on their own finances or those of their relatives to be able to pay for health services. This is one of the main reasons for not undergoing timely caesarean sections in many countries. Local communities should be encouraged to embark on microfinance projects and revolving community credit schemes to help finance promote prompt access to emergency obstetric services when problems arise. Such projects could be facilitated within their catchment areas by fistula centres. Research in this area should be encouraged [125-130].

d) The Indian example

A national family health survey in India revealed that 65% of the births in rural areas took place in the homes of the women's parents and that only one in seven deliveries was attended by trained health practitioners. According to the Indian government's annual report in 2001-2002, maternal morbidity and mortality had not changed in the last four decades [131]. In the three years preceding the India's National Family Health Survey 1998-1999 (NFHS-2), 35% of pregnant women received no antenatal care. This is only marginally better than the 36% in the 1992-1993 NFHS [132]. The government shifted its focus during the 1990s from contraceptive and fertility reduction targets and incentives for population control toward a broader system of performance goals and measures designed to encourage a wider range of reproductive and child health services. This approach seeks to address issues such as safe motherhood, safe abortion, and the quality of health services. Under this broader approach, the government initiated the Child Survival and Safe Motherhood Programme in 1992 in partnership with the World Bank and the United Nations Children's Fund (UNICEF). In spite of such measures vesicovaginal fistulas and other urinary fistulas are still common. In rural areas, the majority of women with fistulas are not getting proper treatment. The results of surgery by surgeons who operate on these problems only rarely are so poor that many of them have abandoned the treatment of such cases altogether. Although the surgical results are good in hands of experienced surgeons, such practitioners are often more interested in procedures that have the potential for high financial gain, such as endo-urology and laparoscopy. Consequently, the majority of fistula patients are neglected. In urban areas where more surgeons are available, early caesarean delivery in cases of prolonged labour has reduced the obstetric causes of fistulas but there has been a concurrent increase in the number of fistulas resulting from gynaecological surgery (vesicovaginal fistulas, ureterovaginal fistulas, and uterovaginal fistulas).

In Kerala, one of the states of India that has achieved universal literacy, institutional deliveries have been made compulsory. This has resulted in a drastic reduction in maternal morbidity, and particularly in a reduction of obstetric fistulas [133]. In Kerala there is a more equitable distribution of health facilities and consequently better utilisation. Improved education has increase access to such services and there is also is a higher degree of political awareness among the people in rural Kerala. Nag concluded that governments should give higher priority to social equity than to economic equity. In that state a rising trend in caesarean rates is seen and up to 28% of the first live births occurred by caesarean section [134]. The availability of these services is much appreciated by the local women and the use of the services was excellent (99% of a cohort of women participating in a survey visited a doctor at least 3 times during the pregnancy [135].

IV. CLASSIFICATION SYSTEMS

There is currently no uniform system for classifying fistulas and a wide variety of different systems have been proposed. Classification of fistulas is important only to the extent that the classification has a meaningful relationship to the prognosis of the injury. In recent attempts at fistula classification the size of the fistula and involvement of the urethral closing mechanism are taken into account. Some systems attempt to classify fistulas according to the anticipated degree of difficulty of the repair, while others classify them according to the type of surgical intervention that will be needed [36]. Systems based on the anatomical appearance of the fistula do not necessarily predict the difficulty of repair nor the post-operative prognosis [136]. **Table 4** lists the most common classification systems in current use. Recently a large international multicenter study has started in an attempt to develop a prospectively-validated system for classifying fistulas (R. Genadry, personal communication 2008).

V. CONSERVATIVE MANAGEMENT

Little is known about the conservative treatment of vesico-vaginal fistula. As mentioned above, the diagnosis of a fistula is often missed by medical staff in the early phase after its development. This may be due to neglect by the staff or due to a patient who is eager to return home as soon as possible after delivery who simply thinks the initial urinary leakage is a normal consequence of her difficult delivery. Waaldijk published his personal experience with the conservative approach to fresh obstetric fistula [137-139]. He reported a series of 1716 patients with fresh obstetric fistulas, of whom 265 were treated conservatively with a CH 18 indwelling catheter. If there was no sign of healing after 4 weeks, a surgical approach was utilized. All but one of these women were cured by catheter drainage alone. Unfortunately, he provided no data on fistula size or location in this subgroup.

A recent evidence-based review by Bazi T. on the spontaneous closure of vesicovaginal fistula after bladder drainage alone came to the following conclusions [140]:

- It was not possible to correlate the aetiology of the fistula (obstetric or gynaecologic) with the likelihood of success

Table 4 : Classification systems

Classification	Description	Size
Marion Sims (1852)	1) Urethrovaginal 2) Bladder neck 3) Body and floor of bladder 4) Utero-vesical	
Mc Connachie (1958)	Grade 1: normal healthy tissue Grade 2: mild scarring Grade 3: more scarring, poor vaginal access Grade 4: repeat repair Grade 5: inoperable per vagina	Type A: <1cm Type B: >1 but <2cm Type C: >2cm Type D: A,B or C with rectovaginal fistula
Lawson (1968)	1) Juxta-urethral 2) Mid-vaginal 3) Juxta-cervical 4) Vault 5) Massive combination fistula	
Hamlin (1969)	1) Simple vesico-vaginal 2) Simple recto-vaginal 3) Simple urethra-vaginal 4) Vesico-uterine 5) High rectovaginal fistula 6) Complex fistula	
Waaldijk (1995)	Type 1: not involving closing mechanism Type 2: involving closing mechanism A) Without (sub)total urethral involvement B) With (sub)total urethral involvement a. No circumferential defect b. Circumferential defect Type 3: ureteric and exceptional fistula	
Arrowsmith (2007)	***Scarring score:*** 1 mild 2 moderate 3 severe ***Urethral status score:*** 0 intact, 2 partial damage 3 complete loss	
Goh (2004)	***Location of fistula:*** Type 1: distal edge >3,5cm from urethral meatus Type 2: distal edge 2,5-3,5 cm from urethral meatus Type 3: distal edge 1,5-2,5cm from urethral meatus Type 4: distal edge <1,5cm from urethral meatus ***Fibrosis :*** i. None or mild ii. Moderate or severe iii. Special consideration	a) <1,5cm diameter b) 1,5-3cm diameter c) >3cm diameter
WHO (2006)	***Good prognosis/simple:*** Single fistula Vesicovaginal fistula Closing mechanism not involved No scarring No circumferential defect Minimal tissue loss Ureters not involved First attempt to repair ***Complicated/uncertain prognosis:*** Multiple fistula Rectovaginal, mixed fistula, cervical fistula Closing mechanism involved Scarring Circumferential defect Extensive tissue loss Intravaginal ureters or bladder stones Failed previous repair	<4cm > 4cm

- Most fistulas reported cured by catheter drainage alone are small, usually less than 1 cm in diameter.
- It was not possible to establish a relationship between fistula size and outcome, although a 5mm diameter has been set as an arbitrary cut-off limit.
- Duration of drainage utilized varies between 10 days and six weeks, but has not been studied properly
- No data are available on which type of catheter drainage yields the best results
- Fresh fistulas are more likely to close than those of longstanding duration

The conclusion reached was that conservative management of a fresh fistula may be an option in small fistulas, but it healing has not taken place within a few weeks, surgical repair will likely to be required for cure.

VI. SURGICAL MANAGEMENT

Fistula surgery requires some form of anaesthesia. The position used during fistula surgery depends on the nature and location of the fistula to be repaired. For the vast majority of fistulas a high lithotomy position with the buttocks pulled well over the edge of the operating table (in steep Trendelenburg position), with or without episiotomies provides excellent exposure (**Figure 9**)**.** Surgery in this position can safely be performed under spinal anaesthesia, which is the cheapest and easiest form of anaesthesia for "low technology" settings in developing countries. Spinal anaesthesia can be administered by the surgeon which is an advantage over general anaesthesia [141].

Vaginal surgery for small fistulas can be attempted under local anaesthesia [142]. Larger or more complex fistulas can be treated under spinal anaesthesia, which is to be preferred over epidural or general anaesthesia [143]. Spinal anaesthesia will yield a better pain control than epidural anaesthesia in rural settings [144].

Alternative positions are the knee-chest position, which is uncomfortable for the patient and generally requires intubation. Operating by the abdominal route increases the cost and time of the operation, but is still often performed for some high fistulas where surgical access is problematic. Experienced fistula surgeons may be able to repair such defects vaginally. A retrospective study by Chigbu compared the outcome of juxtacervical fistula through the vaginal or abdominal approach [145].

Both approaches had similar cure rates and hospital stays, but the abdominal route was associated with a significantly higher need for blood transfusion. General anaesthesia is also more expensive, more complicated to administer, carries more risks, and should therefore be reserved for those patients who need an abdominal approach.

(SOLFA, used by permission)

Figure 9 : Positioning for fistula repair

1. THE SIMPLE FISTULA

In practiced hands, skilled fistula surgeons routinely achieve a closure rate of over 80% for simple fistulas at the time of first operation. Multiple papers reporting large case series support this contention [29, 49, 71, 94-103, 146-161].

A fairly general consensus concerning the basic principles of fistula repair was reached at the first 'Fistula Surgeons Experts Meeting' at the WHO in Geneva 2004. These principles can be summarized as follows:

- The best chance for successful fistula closure is at the first operation and closure rates tend to diminish with each subsequent attempt at operative repair. In their large series of 2,484 obstetric fistula patients, Hilton and Ward (1998) reported successful fistula closure in 82.8% of patients at the first attempt. Successful closure was achieved in only 65% of those patients who required two or more operations. Another unpublished series of 400 patients from the Addis Ababa Fistula Hospital reported a successful closure rate of 92% and urethral incontinence of 33% at the first operation, a closure rate of 73% and urethral incontinence rate of 50% at the second operation and a closure rate of only 52% and urethral incontinence of 75% at the third operation (Browning, personal communication)**.**
- The ureters should be identified and protected to ensure they are not cut or ligated during the fistula repair (if the site and size of the fistula puts them in proximity to the operative field).
- The fistula should be widely mobilized from the surrounding tissues at the time of repair.

- The fistula should be closed without tension on the site of repair.
- The repair must be 'water-tight'. To ensure this, a dye test is performed intra-operatively and if there is still leakage, the repair is sutured again. There is one very experienced fistula surgeon who does not do this, preferring to drain the bladder continuously for up to 4 weeks postoperatively.
- After fistula repair the bladder should be kept on free drainage for 10-14 days. There is some weak evidence that 10 days of drainage is just as effective at six months follow up (for fistulas of less than 3 cm diameter with mild to moderate scarring) [162]. This change in catheter management could make a significant impact on the resources of hospitals where these operations are performed. If the time needed for postoperative bladder drainage could be reduced by 4 days, the capacity of the hospital to care for fistula patients would increase by 30% just from this gain in efficiency.
- There is debate as to whether or not a Martius bulbocavernosus flap or other graft should be used in fistula repair. The argument has always been that such practices bring in a new blood supply to help nourish the injured tissues surrounding the fistula. One retrospective paper compared the surgical outcomes of operations involving similar fistulas repaired with and without use of the Martius flap and demonstrated a higher successful closure rate when such a flap was employed [163]. Another more recent retrospective analysis evaluated 400 patients in which comparable fistulas were repaired with and without the use of a flap showed no differences between the two groups in closure rates or postoperative incontinence rates [164]. Many experienced fistula surgeons now only use grafts under rare circumstances, such as when the urethra has been reconstructed, when the tissues are particularly poor, or if there have been multiple previous attempts at repair.
- The defect in the vagina is closed.

Each fistula is unique, and an ability to improvise in the face of unexpected findings or complications is a virtue that every fistula surgeon must strive to develop. However, by following the above principles and the application of these to each fistula, most defects can be closed with a high success rate (**Figure 10**).

While it is impossible to describe in detail every type of fistula that might be encountered, the following is a general description of the flap-splitting technique of fistula repair developed by the Hamlins in Ethiopia and used in the repair of nearly 30,000 fistulas. This technique is currently employed by the majority of fistula surgeons around the world. The different steps of this generally accepted technique are illustrated in figures 11-19. The operation described is for a simple, uncomplicated fistula.

What constitutes a "simple case?" This is a case that has a high chance of cure and is suitable for those without expensive experience in fistula surgery. Only about 20% of obstetric fistulas can be defined as simple. Simple fistulas are less than 3 cm in diameter, with no or only mild scarring and do not involve the urethra . The first pre-requisite for successful fistula repair is meticulous attention to detail. As Abbott aptly (if somewhat quaintly) noted [149], "There must be no attempt to operate on these cases with one eye on the clock and the other on the tea wagon". In fact, the operator upon vesicovaginal fistulas should combine traits of daintiness, gentleness, neatness and dexterity of the Pekinese, with the tenacity and perseverance of the English bulldog."

After positioning the patient on the table the surgeon must obtain adequate exposure of the operative field. Figure 11 depicts a typically narrow, scarred vagina of the type that often develops after obstructed labour (**Figure 11**). For simple cases without scarring, the use of a weighted Auvard speculum should be sufficient. Sometimes an episiotomy is required to increase the exposure. The ureters should then be identified and catheterized. This can usually be done by passing the catheters through the fistula under direct vision **(Figure 12)**. Note that for very small fistulas in the midline or for urethrovaginal fistulas well away from the ureters, this step may not be needed. Once the ureters have been catheterized, the ureteral catheters can be brought out of the bladder through the urethra, keeping them away from the operative field. Although some fistula surgeons leave the catheters in place for up to 14 days after surgery, most can be removed at the end of the operation or a few days afterwards.

Once the fistula is exposed and the ureters protected, the next step is to mobilize the bladder/urethra from their surrounding structures (**Figures 13-17**). The proximal margins of the fistula are incised and the incision is then extended laterally from the angles either side. Using traction and counter-traction the tissues planes are developed. The distal margins of the fistula are also incised. Two flaps are then developed, again using traction and counter-traction and sutured away to the labia. The fistula edges should now be fully exposed and mobilized. The mobilization should be adequate to be able to bring the margins of the bladder defect together under no tension. Often the angles of the fistula are adherent to the inferior pubic ramus either side. Releasing these attachments close to the bone gains much more mobility **(Figure 17).** This dissection can extend into the space of Retzius. It is also noted that the majority of the mobilization comes from the proximal dissection, not from the distal dissection and the amount of dissection reflects this. The distal dissection should really be only enough to secure a suture. It is best not to over dissect here and merely create scarring around the urethra.

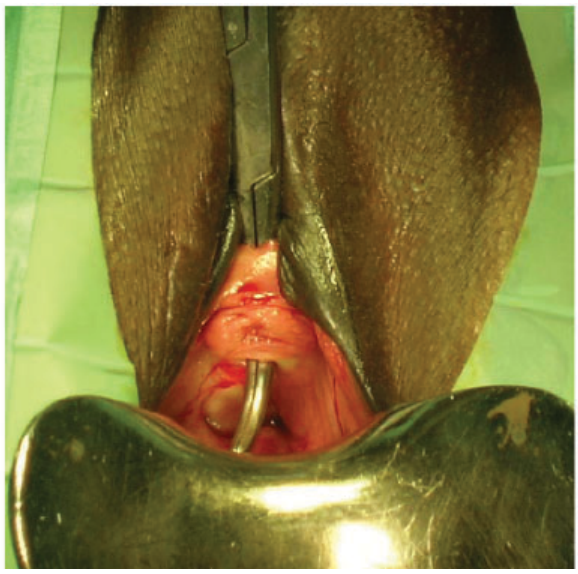


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Figure 10 : a simple fistula

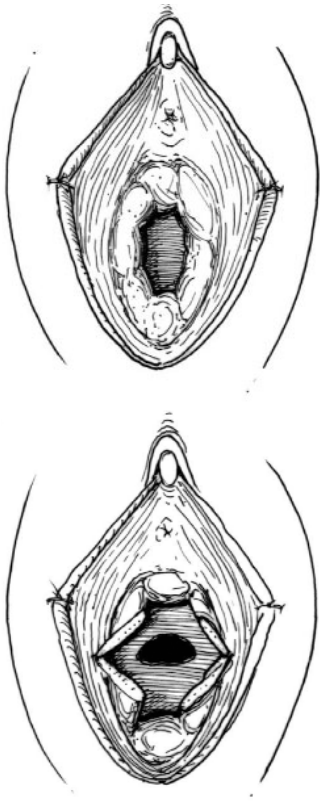


Figure 11 : Exposure of the fistula. ***The illustration to the left shows a vagina that has been narrowed considerably by scarring, thus making the fistula difficult to see. Because adequate exposure of the operative field is the most important criterion for successful surgery, exposure must be improved in such cases. This is done by cutting a generous lateral episiotomy through the scar tissue on either side of the vagina. Although this is unavoidable in some case, the surgeon must remember that such incisions may bleed significantly and increase intraoperative blood loss. (Copyright Worldwide Fistula Fund, used by permission).***

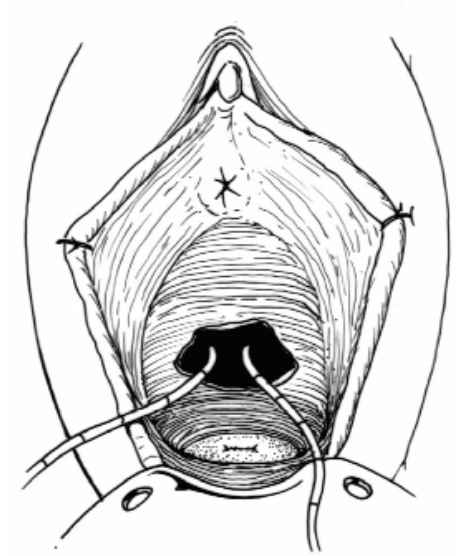


Figure 12 : Catheterisation of the ureters. ***Knowledge of where the ureters are located is extremely important in fistula surgery, as closure of the fistula may inadvertently lead to ureteral injury. Particularly if the fistula is large, the surgeon should look for the location of the ureters in relation to the edges of the fistula. Giving the patient intravenous furosemide or indigo carmine dye, may help locate the ureteral orifices. When the fistula has been closed and the operation is over, the ureteral catheters may simply be removed. There is no benefit to keeping them in longer post-opeartively, unless there are special circumstances. (Copyright Worldwide Fistula Fund, used by permission).***

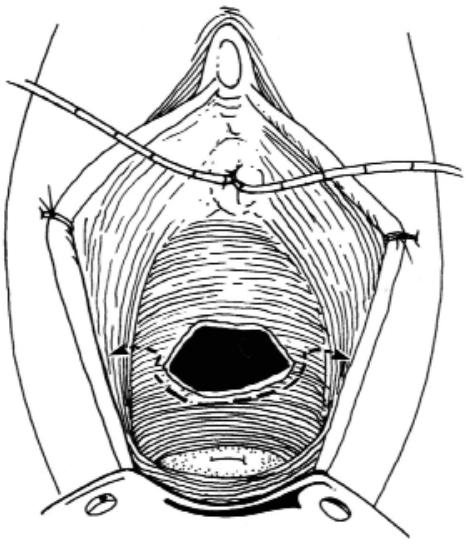


Figure 13 : The initial incision. ***The initial incision should be made directly along the vesico-vaginal junction on the posterior edge of the fistula (see previous figure). The incision should be extended well out onto the lateral vaginal sidewalls. The purpose of the large incision is to allow wide mobilization of all tissues surrounding the fistula so that the fistula may be closed without any tension on the suture line. Very broad mobilization of tissues is especially important in more complicated fistulas and fistulas with extensive scarring. (Copyright Worldwide Fistula Fund, used by permission).***

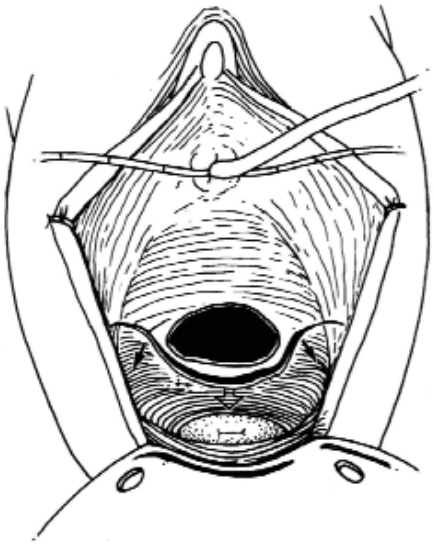


Figure 14 : Extension of the initial incision.
Once the incision has been made, it should be extended posteriorly, freeing the vagina from the underlying bladder. The initial opening of the incision is often facilitated using Thorek scissors, which have right-angled blades. Once the initial incision has been opened, the spaces can be widened using the Potts-Smith dissecting scissors. Blunt dissection with a finger to open these tissue planes is to be encouraged. (Copyright Worldwide Fistula Fund, used by permission).

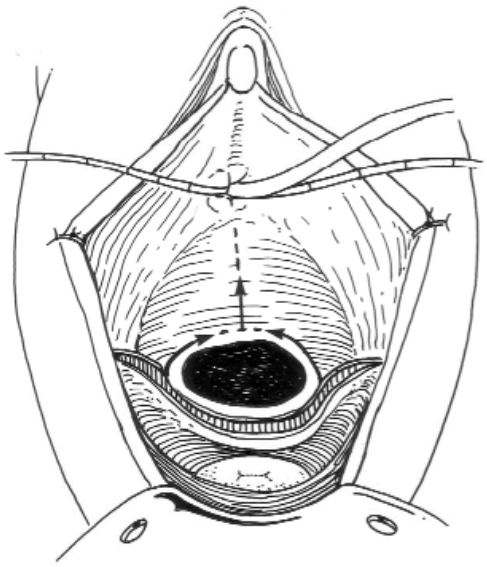


Figure 15 : Anterior extension of the incision around the fistula and into the anterior vagina.
Again, the purpose of dissecting the fistula out from the surrounding tissues is to gain mobility so that the fistula can be closed with minimal tension. This involves mobilization of large areas of the vagina. (Copyright Worldwide Fistula Fund, used by permission).

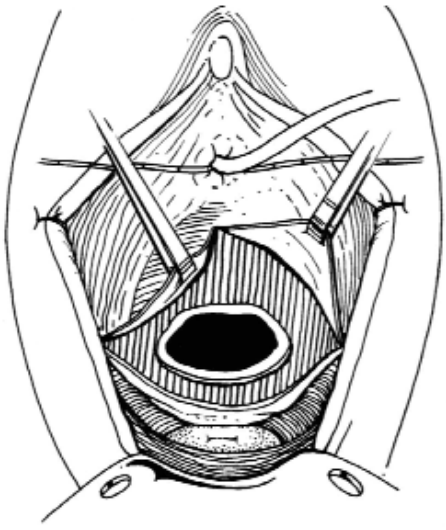


Figure 16 : Creation of anterior vaginal flaps.
Once the initial incision around the fistula has been extended anteriorly, the dissection is carried out laterally to separate the vaginal skin from the underlying bladder. (Copyright Worldwide Fistula Fund, used by permission).

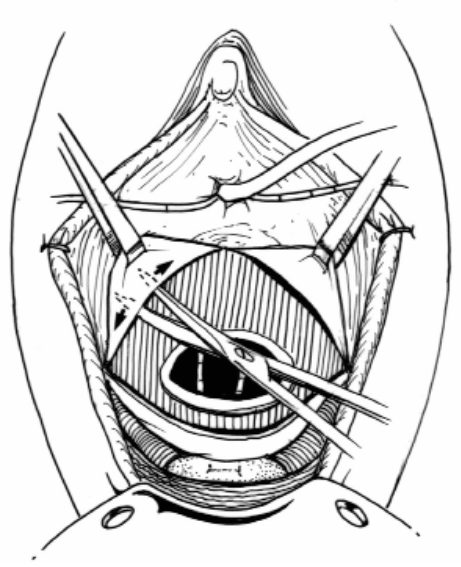


Figure 17 : Entering Retzius' space.
Mobility is further increased by penetrating the endopelvic fascia underneath the pubic rami and opening the space of Retzius. This further increases lateral mobility of the bladder and vagina. (Copyright Worldwide Fistula Fund, used by permission).

Once the fistula is adequately mobilized, it is closed. Traditionally, fistula closure was done by closing the bladder in two layers. Many surgeons now closed the bladder in one layer using interrupted dissolvable sutures placed approximately 4 mm apart **(Figures 18, 19, 20)**. The adage for the trainee is that 'a good tension-free closure with adequate good healthy tissue has no reason to fail'.

The repair is then examined to ensure that 'water-tight' closure has been achieved by filling the bladder with 60-120 ml of coloured dye (dye test). Occasionally during this test a second fistula previously unknown will be found. If present, this, too, must be closed.

Once the fistula has been closed, the vagina is next repaired. When this has been finished, a vaginal pack is placed, and the urinary catheter is left in situ. The following day, the vaginal pack is removed and the patient is encouraged to mobilize and eat.

The bladder is left on continuous free drainage for 10-14 days. Each day the '3-Ds' of post-operative fistula repair are checked. These are whether the patient is dry, drinking and the catheter is draining. The patient has to be dry; that is the fistula repair must be intact; drinking to ensure adequate irrigation of the bladder; and draining, that is, the catheter is not blocked. If the catheter does become blocked and the bladder fills, the repair is at risk of breaking from

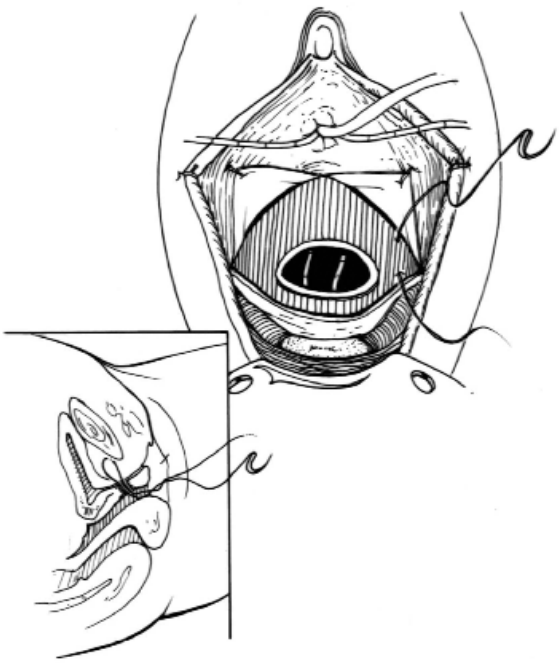


Figure 18 : Placement of supporting stitches. ***Particularly in cases where the bladder neck and urethra are poorly supported, improved anterior vaginal support can be obtained by placing anchoring sutures into the tissues lateral to the edge of the fistula and then passing such sutures through the periosteum of the pubic arch (as shown in the inset). These sutures help decrease tension along the line of bladder closure. (Copyright Worldwide Fistula Fund, used by permission***

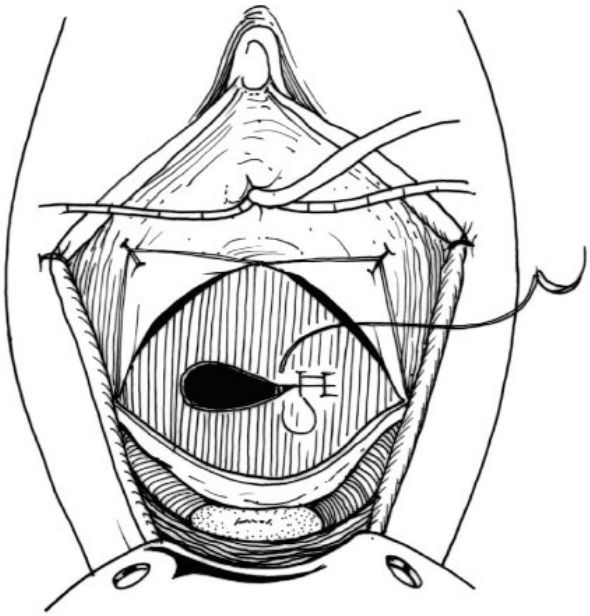


Figure 19 : Initial closure of the fistula. ***The defect in the bladder is closed using absorbable suture. Many surgeons prefer to close the bladder in two layers, so that the initial closure is reinforced; however, others do not do this. If any tension is encountered during bladder closure, this indicates that the initial dissection of the tissues around the fistula was inadequate and should be revised. (Copyright Worldwide Fistula Fund, used by permission).***

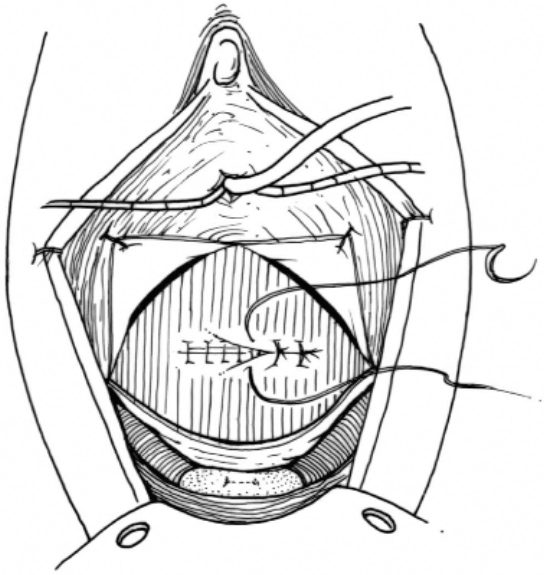


Figure 20 : Closure of the fistula, second layer (if needed). ***A second set of sutures is placed to imbricate the second line of closure over the initial line of closure. This can be done either with interrupted sutures (shown here) or with a continuous running suture. When this line of closure is completed, the fistula should be "water tight." Closure of the fistula can be tested by placing a trans-urethral Foley catheter and then filling the bladder with 100 – 200 mL of either colored water (indigo carmine, methylene blue, Gentian violet) or sterile infant feeding formula to check for the presence of leaks. If any leakage is noted, the repair should be reinforced with additional sutures until no leakage is demonstrated. If such leaks are not easily fixed it is better to take down the entire repair and start over rather than to struggle with repeated attempts to place additional sutures here and there. (Copyright Worldwide Fistula Fund, used by permission).***

increasing tension on the repair site. If the catheter does become blocked and the repair ruptures, this may often be rectified by continuous prolonged catheter drainage. By ensuring an empty and relaxed bladder, the sides of the defect may come together and close, but this can take as long as 4 weeks to occur. The success rate is about 70% in such cases, less if the defect involves the urethra.

Following these principles in the repair of simple fistulas, the surgeon can anticipate successful closure in 90% of the patients and a postoperative urethral incontinence rate ("closed but still wet") of 10%.

2. THE COMPLEX FISTULA

A complex obstetric fistula can be described being larger than 3 cm, involving the

- urethra, and associated with reduced vaginal capacity from significant scarring and/or a reduced bladder volume. Sometimes the defect may be urethrovaginal, but more commonly both the urethra and bladder are involved and therefore the fistula is called an urethrovesicovaginal fistula.
- Virtually all authors with extensive experience in the management of obstetric fistulas comment on the great difficulty in achieving postoperative continence in patients who have had extensive damage to the urethra, even if the defect itself has been closed successfully. Rates of postoperative urethral incontinence range between 6-50% (165) [37, 67]. Often the diagnosis of postoperative incontinence is given only if the patient suffers from severe incontinence while walking. If rigorous questioning is used to exclude any leakage with coughing or other exertion, the rate of postoperative incontinence increases dramatically.
- The four risk factors that lead to a high rate of incontinence following fistula repair are:
- Urethral involvement. (Odds Ratio 8.4 for developing urethral incontinence post operatively.)
- Large size of the fistula. (Odds ratio 1.34 for each cm increase in size of the defect.)
- Severe vaginal scarring. (Odds Ratio 2.4 if the scarring is significant enough to prevent the introduction of a Sims speculum without relaxing episiotomies.)
- Small bladder size. (Odds ratio 4.1 if the bladder capacity is less than 120 ml.) [166].
- In repairing complex obstetric fistulas, the principles for simple fistula repair still apply, but with the following additions:
- Exposure is more difficult. In complex cases the fistula may be obscured from view due to the presence of severe vaginal scarring. Such scaring often consists of a thick band of scar tissue on the posterior vaginal wall. Occasionally, the vagina has been completely occluded. Wide bilateral episiotomies may be required and where possible the scar should be released from the lateral pelvic sidewalls. This will enable the fistula to be seen more clearly.
- The ureters should be identified and protected against possible injury, as in the case of a simple repair.
- The bladder and urethra should again be carefully mobilized. The tissues are often thin, scarred, and fragile in such cases. The mobilization often has to be extended along the lateral pelvic side walls and even on to the posterior aspect of the pubic symphysis in order to free the lateral and anterior bladder.
- The mobilization of tissues should be wide to ensure a tension-free closure.
- The utility of tissue flaps remains controversial.
- Often destruction to the vagina has been so extensive that rotational flaps are required in order to cover the defect [167].

If these principles are applied, the success rate in fistula closure is high, but many women remain incontinent despite successful closure. In patients in whom all of the risk factors mentioned above are present, the postoperative incontinence rate may approach 100% [160]. In light of this dismal success rate, some surgeons now suggest that two further principles of repair be maintained:

Maintain the urethral length. It has been noted that post-repair fistula patients returning for further treatment of persistent urinary incontinence often have a shortened urethra. An unpublished series of 72 patients with post fistula repair incontinence found an average urethral length of 1.4 cm in these women. This suggests that continence might be improved if normal urethral length can be restored at the time of fistula closure. Vertical (as opposed to horizontal) repair of urethrovaginal fistulas has therefore been suggested. This appears to be possible in approximately 20% of such cases. In cases in which there is an urethrovesicovaginal defect, vertical repair of the urethral defect may improve success, while the vesical defect can be repaired either vertically or horizontally.

Support the urethra. For all urethral defects larger than 4 mm with a urethral remnant less than 2.5 cm, many fistula surgeons use an 'anti-incontinence' procedure during the initial repair. Currently there are two widely used procedures. The first sutures the urethra/bladder neck to the periosteum of the pubic ramus in a type of suspension operation. The fascia or muscle of the bladder is sutured on either side of the bladder neck area to the posterior aspect of the symphysis pubis or the arcus tendineus [141]. The

second procedure creates a sling of tissue to support the urethra. A pedicle of tissue is created on either side of the urethra from the lateral pelvic side wall. In theory this involves use of the pubococcygeus muscle, but more often it is simply a pedicle of fibromuscular tissue or scar that can be harvested. The pedicles created on either side are then sutured together in the midline [160, 166].

If either of these two extra steps are used, the incontinence rate after closure of complex fistulas can be reduced from 100% to 50% [160]. If all simple and complex fistulas are treated according to these extra principles, the postoperative incontinence rate can decrease from 33% to 18%.

a) The circumferential fistula

J. Chassar Moir, referred to the worst of obstetric fistula cases as "circumferential" fistula, which "involve a destruction of the bladder neck not only on the vaginal side, but in many instances, on the pubic side as well. The result is a circumferential sloughing with subsequent discontinuity of the urethra and bladder; the intervening tissue is merely the epithelium that has grown over, and become adherent to the periosteum of the back of the pubic bone." [153]. This type of injury seems to occur more frequently in primiparous women, who tend to be younger. Such defects are more likely to be associated with severe vaginal scarring, the presence of a recto-vaginal defect, larger defects, and urethral involvement in 96% of cases [168].

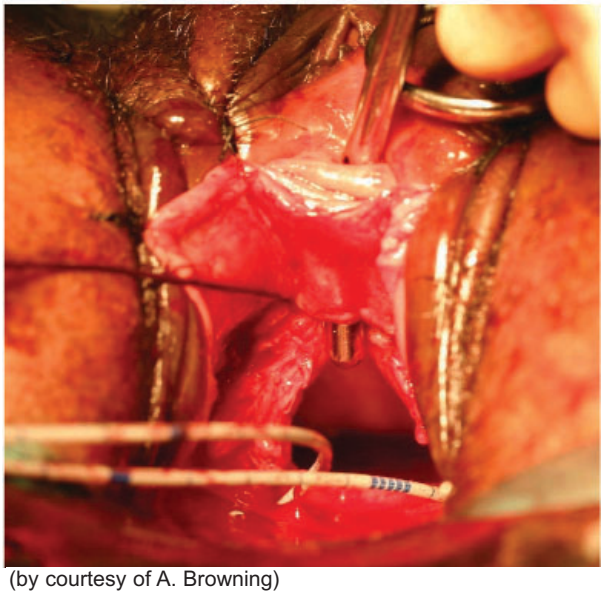
In repairing these injuries, some fistula surgeons ignore the anterior defect in the bladder and merely repair the posterior section by suturing the bladder along the periosteum of the posterior symphysis pubis and then to the urethra. The anterior portion of the urethra will thus be pubic bone. These patients invariably suffer severe post-operative urethral incontinence, and the shorter the urethral remnant is to begin with, the more severe their incontinence is likely to be [169].

According to Moir, the three great problems involved in dealing with this type of fistula are: 1) extremely difficult exposure; 2) technical difficulty in dissecting the tissue remnants from the pubic bone; and 3) difficulty in joining the bladder neck to the urethral remnant or stump, if, indeed, any portion of the urethra is still intact. In order to deal with this type of injury, the bladder must be completely mobilized so that it can be drawn down low enough to create a tension free anastomosis with the urethral remnant. Freeing the urethral remnants and bladder from their adherence to the pubic bone may even require a suprapubic incision with the dissection from above in order to accomplish this. In such cases Moir took care to reinforce the bladder neck with buttressing sutures and generally brought in a Martius graft for support and a renewed blood supply. Today many experienced surgeon perform this operation entirely through the vagina and rarely use the Martius graft, but employ the continence saving steps to the procedure as described previously. The basic principles still apply, but emphasis is placed on completely releasing the bladder from any attachments to the posterior symphysis pubis. Once the bladder has been released, it is drawn down posteriorly to expose the plane of dissection between the bladder and pubic bone.

Once the bladder is mobilized circumferentially it is anastomosed to the urethra anteriorly with sutures at 12, 9 and 3 o'clock around the proximal section of the urethral remnant, usually anchoring it to the periosteum of the posterior pubic symphysis for stability. Often the distal defect in the bladder/urethra is much larger than the proximal defect in the bladder. To perform the anastomosis with this discrepancy in size, the bladder is pulled around the proximal part of the urethra and sutured. The remaining defect in the bladder is repaired vertically, again in an attempt to maintain the length of the urethra. **(Figure 21).**

The urethra is then suspended or supported with a sling as an anti-incontinence procedure. Despite these measures, post-operative incontinence is still high, with up to 45% of patients still incontinent in the immediate post-operative period [169].

The most difficult injury to repair is when the entire urethra has been sloughed. This may happen in up to 5% of cases [101]. If the urethra is only injured in its posterior aspect, the remaining urethral tissue can be mobilized and repaired vertically over an indwelling catheter with adequate results. More often, however, the whole circumference of the urethra is sloughed. To reconstruct a functional urethra is nearly impossible in such cases.



(by courtesy of A. Browning)

Figure 21 : A circumferential fistula

In cases of complete destruction of the urethra and the anterior bladder neck, Hamlin and Nicholson recommended constructing a new urethra by creating a new "inner" urethra using the skin and fibrous connective tissue covering the pubic bones and the inferior border of the pubic symphysis. The neourethra thus created is then reinforced using a gracilis muscle flap taken from the thigh, preserving its neurovascular pedicle. Once this has been accomplished, additional grafting is necessary using a Martius flap which is then covered with skin flaps. Using this technique, the authors reported no deaths and only one 'complete failure' in 50 operations in which the blood supply to the gracilis flap failed. In some cases small urethrovaginal fistulas remained which were repaired at a subsequent operation. Surprisingly, only 8 women (16%) developed "severe" stress incontinence after this reconstruction, four of whom regained "satisfactory" continence over time, and four of whom required a subsequent operation for stress incontinence. In these latter four patients, only two operations were completely successful. Six patients (12%) developed a urethral stricture, three of whom were successfully treated by the passage of a sound and three of whom required surgical correction. The remaining 35 patients (70%) were discharged within six weeks of surgery cured or with mild residual stress incontinence which did not appear to be clinically bothersome [170]. There is no long-term follow-up on these patients, but anecdotally many patients who have had this procedure have returned for further care years after the operation with incontinence and complete stenosis of the neo-urethra.

Various authors have described neourethral reconstruction using bladder flaps [171, 172]. All of these operations are based upon transabdominal techniques such as that described by Elkins et al. [173]. In this technique, a neo-urethra is created by mobilizing a flap from the anterior bladder, which is then rolled into a tube. The anterior and lateral edges of the fistula are freed up and the space of Retzius is entered transvaginally beneath the pubic bone. The anterior bladder is pulled down into the vagina and mobilised. A 3cm incision is made into the bladder and the anterior bladder wall is then rolled around a 16 Fr. Foley catheter, creating a tube. The anterior surface of the neourethra is then sutured in two layers and the posterior edge of the fistula is closed transversely, also in two layers. The neourethra is reattached to the posterior edge of the pubic symphysis, and a Martius graft is placed before reapproximating the vaginal epithelium. In 18 of 20 cases, this technique resulted in fistula closure, but four women had severe stress incontinence post-operatively. It is not known how many had mild incontinence.

Neither of these surgical methods is ideal. Although they may create an anatomic urethra, often that urethra does not function normally. A further option in such cases is to create a 'tube' using either technique and then attempt to render the patient continent with the use of a urethral plug [24].

b) Additional advanced surgical techniques

Fistula centres in India tend to have more resources available to them than do fistula centres in Africa. In these situations it may be feasible to use more advanced surgical techniques on patients with fistulas. For example, the fistula centre at the Banaras Hindu University (Varanasi) has a substantial experience in managing more than 600 genito-urinary fistulas over a 15 year period. Fistula is common here: it was the most common diagnosis (40.5%) in female patients admitted for surgery in the past five years, followed by urinary stone disease (25.2%) and malignancy (14.6%). Vesicovaginal fistulas were the most common fistula encountered (66.6%) and vesico-uterine fistulas were the least common (5%) (174). Obstructed labour was the most common aetiology of fistulas (72.2%), followed by hysterectomy. Conservative management was successful in only 1-3% of the patients with vesicovaginal fistulas and the remaining cases were managed surgically with excellent results. A transabdominal approach was used for large, supra-trigonal vesicovaginal fistulas, associated uretero-vaginal fistulas or if bladder augmentation and bladder neck reconstruction was required. The transvaginal route was preferred for small sub-trigonal fistulas. A combined abdominal and vaginal approach was used for large fistulas involving the trigone or the bladder neck. The surgical approach varied in each patient. Interposition grafts or flaps were used when required [175]. The overall surgical failure rate was 4.3%. The average operative time for layered closure was 72 minutes (45-130 minutes) and that for graft or interposition tissue repair 100 minutes (90-165 minutes). The mean hospital stay was 9 days (6-17 days). There were no reported intra-operative complications. Postoperative complications were urinary tract infection, haematuria, wound infection and fever. None of the patients required blood transfusion. For the repair of small fistulas, surgeons did not use interpositional flaps but rather used the layered closure technique with a success rate of 97.1%. Complicated fistulas required repair by graft or tissue interposition and had a success rate of 94.8% which is similar to the experience of other Indian centres [176]. Risk factors for the failure of vesicovaginal surgery included previous failed repair, large-sized fistulas, fistulas involving the trigone or ureteral orifices, a small bladder capacity and unhealthy vesical urothelium at the time of surgery. Several techniques were used in addition to the standard layered closure:

1. Vesical autoplasty: If the longitudinal diameter of the fistula was too large to allow simple layered closure and would put the bladder closure under

tension, a vesical autoplasty was performed based on the advancement flap technique used frequently by plastic surgeons. The initial steps are as in the layered closure technique. The vaginal layer is closed with interrupted 3/0 polygalactin sutures. Two incisions are made from either end of the proximal margin of the bladder defect and are extended proximally and laterally to make a wider based bladder flap. This flap is advanced over the vaginal layer and is sutured as in performing a layered closure. This technique avoids overlapping the suture line and also avoids tension [177].

2. O'Connor repair. The majority of the large-sized fistulas were successfully repaired using the trans-abdominal technique described by O'Connor, with interposition of an omental flap (178). This technique works well except when the fistula extends up to the bladder neck or when its transverse diameter is too large to allow tension-free approximation.

3. Ileal segment interposition. This technique is used for fistulas which involve the entire posterior bladder wall or fistulas with a wide transverse diameter that extend up to the bladder neck, cases in which obtaining tension-free closure is difficult. Approximately 15-20 cm of the small bowel is isolated on its pedicle and opened at the anti-mesenteric border. The bladder wall is dissected away from the vagina, which is closed with interrupted sutures. This segment of small bowel is interposed posteriorly, along with an omental flap. This technique has yielded satisfactory results in complicated fistulas, and also augments bladder capacity (175, 179)

4. Bladder mucosal graft: This technique is an alternative to layered closure in cases where closure of the bladder may result in tension along the suture line. If sufficient pliable bladder wall is available, a vesical autoplasty may be performed. In a small-capacity fibrotic bladder, the fistula may be repaired using a free-graft taken from a healthy area in the dome of the bladder, as described by Vyas et al (180). A bladder mucosal graft is also a good alternative in fistulas where the ureteral orifices are close to the fistulous margin and might otherwise require ureteral reimplantation.

5. Combined abdominal and vaginal approach. This technique may be required in complicated fistulas involving the bladder neck. In cases where urethral continuity is disrupted due to a fistula, a combined approach may be preferable. The fistula is repaired by the abdominal route and continuity of the urethra is established by anastomosing the urethra through the vaginal route.

c) Rectovaginal fistula

Rectovaginal fistulas (RVF) are less common than vesicovaginal fistulas in developing countries. In one (unpublished) series of 75 obstetric fistula cases from Ethiopia, only 6.7% were isolated obstetric rectovaginal fistulas and 84% were associated with significant vaginal scarring. Two of the 75 required a temporary diverting colostomy prior to repair; both were high fistulas adherent to the sacral promontory. This compares to 15% needing a diverting colostomy prior to RVF repair in Addis Ababa [165].

The basic principles of vesico-vaginal fistula repair also apply to the repair of rectovaginal fistulas: wide mobilization of the fistula and a tension-free closure. The vaginal epithelium is incised around the circumference of the fistula and laterally from either angle. The vagina is reflected away and the bowel is mobilized, paying special attention to release of any lateral attachments. Severe bleeding can occur along the lateral aspect of the bowel. The bowel muscularis is repaired in 2 layers preferably in a horizontal plane to avoid creating strictures within the bowel lumen. The vagina is then repaired.

3. URINARY DIVERSION IN THE DEVELOPING WORLD

Urinary diversion in developing countries is usually not a viable option since stoma appliances and catheters (in the case of continent urinary diversions) are often unavailable or are too expensive [79]. In such cases performing a diversion procedure merely moves the fistula to another part of the body and the end result of such surgery may be more stigmatizing in the local culture than the original injury!

Uretero-sigmoidostomy has been used as a surgical option in developing countries for many years. Long-term follow-up of a series of 65 Swiss oncology patients over a 20-year period showed early complications in 25 patients (pyelonephritis, anastomotic complications, wound problems) and late complications in 36 patients (pyelonephritis, electrolyte disturbances, ureteral stenosis, incontinence and colon tumour (3)). At 5 years 25 patients had survived: 23 of these (88%) were continent during daytime and 14 (54%) were continent at night as well [181]. These data show that both short- and long-term complications will arise and that surgeons must be prepared to treat them. This requires access to adequate diagnostic equipment. A series of 9 Tanzanian patients undergoing diversion found that results were acceptable and that patients had a marked improvement in their quality of life [182]. The Mainz II pouch or Sigma-rectum pouch was introduced by Fisch et al. to create a detubularized, low pressure, high capacity pouch that would protect the upper urinary tract and improve continence [183]. This technique has also been used in patients with vesicovaginal fistulas. A series of 62 such patients was reported by Arrowsmith (184), 89% of whom were dry during the day and 68% were also dry during the night. Twenty-six patients had major complications, 35 had minor complications, and 6 patients died. The author does not mention the type of complications that occurred.

Urinary diversion with the creation of a sigmoid or rectal pouch is feasible in selected patients. Long-term data on outcome are not yet available. The risk of complications is rather high and managing complications adequately often requires diagnostic capabilities that are absent in developing countries. This situation requires that patients should be counselled extensively before they are offered this kind of surgery [185]. The risk of cancer has to be discussed as well. These discussions must take current life expectancy into account and balance the risk of complications (such as late occurrence of colon cancers) against any improvement in the quality of life. Current life expectancy in Africa is estimated to be 52.8 years, but such numbers vary substantially from country to country due to differing experiences with AIDS, poverty, malnutrition and war [186]. The decision to proceed with urinary diversion must be made jointly by the patient in consultation with the operating surgeon; it is not the surgeon's choice alone. If a diverting operation is performed, it must be performed in a setting in which adequate post-operative follow-up is available. It is inappropriate for a visiting surgeon to perform a complicated operation of this kind and to leave the country without insuring that the patient has competent on-going care should complications arise.

4. COMPLICATIONS

a) Urinary incontinence post fistula repair

1. The continence gap and urethral loss

Fistulas can be closed successfully in 72% to 92% of cases [187]. The definition of success, however, is often different when the perspectives of the patient and the surgeon are compared. "Success" to a fistula patient means complete restoration of urinary continence and control, whereas many surgeons define "success" as simply closing the fistula. It is essential to establish defined criteria that will allow meaningful comparison of treatment outcomes. The patient-oriented criterion of continence restoration should be the goal when the outcomes of various fistula treatments are compared. Persistent incontinence despite successful closure of the fistula has been termed "the continence gap" [188]. A patient whose fistula is closed but who remains incontinent may be just as wet as a patient whose fistula closure operation failed. The estimates of persistent urinary incontinence after a successful closure of the fistula come from case series, ranging from 16.3% in a large retrospective review of patients by Wall et al [29] to 33% in a small series of complex fistulas in which the proximal urethra was lost [189]. Adequate epidemiologic studies on the prevalence of fistula and its sequelae are scarce, and because long-term data on surgical outcomes are difficult to obtain, the prevalence of persistent incontinence after surgery appears to be severely underestimated. Techniques that are used in reconstructive urology in industrialized countries are seldom mentioned in the fistula literature [59, 190]. More research and training is needed in this field.

Persistent urinary incontinence in patients after fistula repair is due to multiple factors including scarring and location of the fistula as well as failure to perform a sling operation at the time of repair in patients likely to require such intervention. The goal of fistula surgery should be restoration of continence and resumption of a full and active life on the part of the patient, not just closing the fistula.

2. Pathophysiology of persistent urinary incontinence after fistula repair

Several possible etiological factors can be postulated in women who remain incontinent after successful fistula closure: massive damage to the mid-urethral continence mechanism, damage to the bladder neck, levator ani dysfunction, damage to the lateral attachments of the urethra, fibrosis and loss of compliance, neuropathy, etc. . . .

Although persistent incontinence tends to be blamed on urethral dysfunction, a few urodynamic studies suggest that bladder dysfunction may play a role as well [67, 191]. A small study of 22 women who underwent urodynamic studies to analyze post-repair incontinence revealed that 41% suffered from urodynamic stress incontinence, 41% had combined urodynamic stress incontinence and detrusor overactivity, 14% had a small non-compliant bladder, and 4% had a voiding disorder and overflow incontinence. In these cases the incontinence may be so severe that the urethra functions only as an open 'drain pipe' through which urine passes in a nearly-continuous stream. The result is little different from the leakage that occurred through the original fistula [67].

3. Assessment of urinary incontinence

A complaint of persistent leakage by the patient needs to be evaluated. The first step is to assure that the fistula has been closed successfully. This can be done by placing a balloon catheter into the bladder, occluding the bladder neck, and filling the bladder with a solution of water coloured with indigo carmine or another type of dye. If the fistula has not been closed successfully, the leakage should be readily apparent. If deflating the balloon or moving it away from the bladder neck produces incontinence, the question may be differentiating transurethral incontinence from a urethra-vaginal fistula. Where more advanced technological capabilities are available, diagnosing the presence of an urethrovaginal fistula may be facilitated by the use of a double-balloon catheter that allows occlusion of the urethra at each end and perfusion of the urethra through an opening between the two balloons. Most commonly, however, the diagnosis will have to be made on the basis of simple

clinical testing by occluding the urethral meatus, asking the patient to strain, and seeing if there is leakage. Limited data from urodynamic studies by Hilton [191] and by Carey, Goh et al [67] suggest that detrusor overactivity and changes in bladder compliance are frequent causes of urinary incontinence is fistula patients with post-repair incontinence, in addition to the leakage resulting from successful closure but persistent intrinsic sphincter deficiency.

4. Management of urinary incontinence

1) Preventive management.

Assessment of host factors causing urinary incontinence following fistula repair:

The best approach to this problem is preventive and this starts with the assessment of host factors. The most important concept is the recognition of the differences between simple and complex fistulas.

Surgical techniques at the time of primary fistula repair to prevent urinary incontinence:

When the fistula involves the continence mechanism and is associated with moderate to severe scarring of the urethrovesical junction, a sling procedure may be advisable to improve urethral closure. Several techniques have been used, including a sling or graft made of labial fat incorporating the bulbocavernosus muscle, remnants of the pubococcygeus muscle, or a gracilis muscle flap [160, 189], as well as fascial grafting. The results obtained with this relatively simple low-cost operative procedure have not been replicated in other centres, nor are there long-term data on outcomes

2) Initial management of urinary incontinence after fistula repair.

Pelvic floor muscle exercises have been proposed as a first step in the treatment of persistent incontinence after otherwise successful fistula closure. Some patients on a muscle exercise regimen improve after six months of therapy. A novel system for grading urinary incontinence has been proposed in an effort to predict which patients are likely to benefit from this type of therapy and which will not. This system is currently in use in only a handful of centres and prospective data are not yet available as to its general applicability.

Continence status after fistula closure can be graded as follows:

1. Cured, no incontinence leaks
2. Wet with exertion (coughing or physical exertion)
3. Wet when walking, but dry when sitting or lying down
4. Wet when walking, sitting, or lying down, but able to void some urine from the bladder
5. Wet all the time, no urine to void

After six months of physical therapy, in 50% of cases women with continence grades 2 or 3 were cured of their leakage, but only 18% of women with continence grades 4 or 5 were cured. Women in this latter group therefore seem likely to require further surgical treatment.

3) Secondary management for urinary incontinence after fistula repair.

If a patient with transurethral incontinence is still complaining of the leakage at follow-up, the treatment proposed must be cheap, effective and not dependent on expensive synthetic materials that are unlikely to be available in countries where obstetric fistulas are prevalent. Treating persistent incontinence after successful fistula closure requires good surgical skills. Some kind of bladder evaluation is essential prior to considering urethral support surgery. The type of repair proposed is based largely on analogies with other urethral operations such as those carried out to repair a urethral diverticulum, to attempt to achieve continence after radiation therapy, or the kinds of reconstructive operations carried out in patients who have extrophy or epispadias [79]. In these cases the use of tissue transposition techniques such as the Martius graft and various forms of sling operations are the mainstays of treatment. The traditional dissection required to place a sling may be difficult and may result in recurrence of the fistula and/or breakdown of the entire urethra. Thus, some authors have recommended using an in situ vaginal sling. Fascial slings are preferred; there is no place for a synthetic sling in these cases due to the levels of scarring found, the lack of vascularity in the surgical field, the high likelihood of infection, and the problems of sling erosion with little or no access to follow-up.

Several surgical methods have been described for treating fistula patients with post-closure stress incontinence; few have been successful and data are quite limited. A standard Burch-type retropubic bladder neck suspension operation combined with urethrolysis and tissue plication, may work in a few patients [141], but in general the results of this approach have been disappointing. Carey and co-workers reported a small series of patients who had undergone previous fistula closure and who later underwent re-operation for stress incontinence. After urodynamic testing, 9 women with severe urodynamic stress incontinence underwent a retropubic urethrolysis and pubovaginal sling procedure combined with placement of an omental J-flap. Four weeks after surgery, 78% were continent; however this fell to 67% at 14 months follow-up [67]. An operation described by Waaldijk involves urethralisation of the bladder neck as a neourethra in patients with a markedly shortened bladder neck. Following this, a fasciocolposuspension to the arcus tendineus is performed. Cure rates of 60-70% have been reported, but these results have not been replicated in other fistula centres [141].

An alternative approach for those patients who fail a surgical procedure or who are deemed unsuitable for an attempt at surgical repair is to use a urethral plug [24]. Although successful use of urethral plugs and various injectable materials has been reported, these technologies are not usually available in areas where obstetric fistulas are common. However, if an ongoing supply link can be arranged, urethral plugs seem to work well for many women with a high degree of patient satisfaction.

Urge-related bladder dysfunction can often be treated with low-cost antimuscarinic drugs. In cases where there has been extensive loss of bladder tissue or marked reduction in bladder compliance due to fibrosis, augmentation cystoplasty can be performed, usually using by interposing a segment of bowel. In some case, urinary diversion may be indicated, but only after careful discussion of the issues involved with the patient.

CONCLUSION

The vast majority of obstetric fistulas can be successfully closed using appropriate "low technology" surgical techniques.; however, making these women completely continent and restoring their lives to normal functioning is the ultimate, but more difficult to achieve, goal. Persistent incontinence after fistula repair remains an underappreciated condition that requires further attention if overall outcomes are to be improved. There is a need for further research using clearly-defined outcomes and standardized data collection in this area.

VII. ORGANISATION OF FISTULA CARE IN THE DEVELOPING WORLD

1. LOCAL HOSPITAL OR A SPECIALIST FISTULA CENTER?

At the present time the care of fistula patients is not well-structured. Fistula centres are not networked with one another and most places where fistula surgery is performed carry out their work without much reference to the activities of other centres. Most fistula care is provided by individuals working alone, and by various charities and non-governmental organizations who largely "march to the sound of their own drums." Funding for fistula initiatives is haphazard and frequently insecure. Around the world, the voices of women with fistulas are still not heard by most of the national healthcare systems that should be responsible for providing care to them. Wall has suggested that a fistula centre can survive and flourish only if three prerequisites are in place [192] . A fistula centre must have:

a) Adequate long-term funding

This funding usually must come from foreign donors, as local authorities often do not consider the care of fistula patients to be an important priority. Because fistula patients are largely destitute, they can rarely pay for the costs of care. This means that fistula surgery must be heavily subsidized in order to reach the maximum number of patients and this may breed resentment in hospitals where other patients are routinely charged for their care.

b) A dedicated fistula surgeon

A surgical program will only succeed if it is staffed by competent, responsible surgeons. Ideally the surgeon in charge of a fistula repair program should be someone who can treat both simple and complex fistulas, as well as with the complications of surgery (e.g., vaginal stenosis, persistent incontinence, etc). Surgeons must understand both their own limitations as well as the limitations placed on them by the environment in which they must operate. Maintenance of skills and improvements in data collection and research are likely to be improved by enabling the formation of networks of fistula surgeons who face similar problems in different parts of the world.

c) Adequate operating theatre time and adequate supplies

Surgical programs can only be successful if there is adequate time and adequate supplies to perform the necessary operations. General hospitals (especially rural hospitals) tasked with taking care of the entire range of medical and surgical problems—-particularly obstetric emergencies and acute trauma—- often lack the resources need to carry out large numbers of fistula repairs. Elective scheduled cases such as fistula repair are always in jeopardy of being bumped from the operating theatre schedule due to the arrival of victims of a road traffic accident, orthopaedic trauma or obstetric haemorrhage.

For these reasons many advocate that fistula programs be organized around a specialized fistula centre that focuses on these patients as its highest priority. Such a centre is optimized to deliver high quality specialized care for these women. Focused programs of this kind will be more difficult to operate in regions where transportation is difficult, making it difficult for people from remote areas to reach the centre.

It is also obvious that the small number of specialist centres that currently exist in Africa will never be able to treat all of the women currently living with fistulas. Whatever strategy is proposed, it must be based on a realistic assessment of local circumstances [193] [194]. Further research in this area is recommended.

Wherever possible, fistula care should be integrated into a broader preventive perinatal care program. A recent systematic review of inequalities in maternal health care in 23 developing countries showed a wide

variation in the use of antenatal care [195]. In addition to factors related to the availability of health care services (distances travelled, clinic availability), user-related factors such as patient age, education, medical insurance, and clinical risk factors played a role in determining utilization. The interactions among these factors are also influenced by funding, organisation, the structure of the local social system, and local cultural variations. The authors concluded that context-specific causes of variations in the use of maternal health care services needs further investigation.

One over-arching concern must be the standard of care provided in such programs: Poor quality antenatal care will almost certainly decrease the utilization of the services provided [196]. How fistula care should be organized must be seen within this larger context **(Figure 22).**

2. ETHICAL CONSIDERATIONS

There are many ethical issues intertwined with the epidemic of obstetric fistulas in developing countries. These issues range from the broadest human rights concerns arising from a devastating problem that only afflicts women to the most intimate issues involved in the responsibilities of individual surgeons for the care of individual patients to complex issues regarding clinical research. Everyone involved in caring for women with obstetric fistulas must realize the vulnerable nature of this patient population and the special needs they present for those entrusted with their care. Recently a code of ethics for the fistula surgeon was published with the aim of fostering common goals and a common ethical perspective as to how the campaign to eradicate fistulas ought to proceed [197]. This code of ethics emphasizes the following basic points: [197].

- The fistula surgeon should be dedicated above all else to providing the best possible care for women with obstetric fistulas permitted by the resources available and the local circumstances in which care is rendered.
- The surgeon must recognize the vulnerable nature of this population of patients, treat them with respect, and involve them in decision-making regarding important aspects of their care. Such patients should not be subjected to experimentation without their consent and research on fistula patients should be overseen by an appropriate ethical review board.
- The fistula surgeon must assume direct personal responsibility for the care of those patients on whom he or she operates and must provide them with access to competent ongoing care, particularly in the immediate post-operative period.
- The fistula surgeon should limit his or her practice to that which he or she is competent to deliver by education, training, experience, and available resources, and should not hesitate to refer complicated patients to a higher level of care.

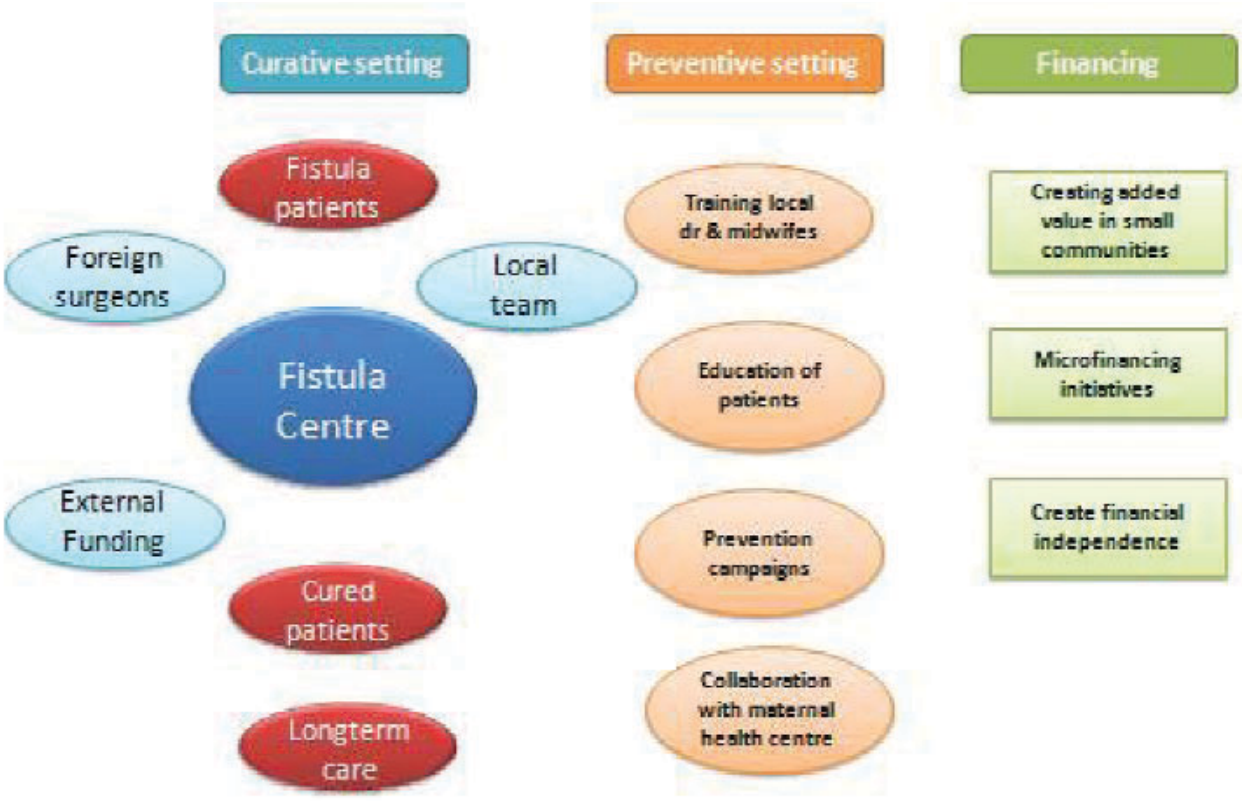


Figure 22 : The organisation of a fistula centre

- The fistula surgeon should strive to improve his or her clinical skills through the regular collection and review of objective data on treatment outcomes.
- The fistula surgeon should never take advantage of a patient for his or her own personal benefit or allow such patients to be abused by others.
- Fistula surgeons must acknowledge the fundamental social inequalities that promote the development of obstetric fistulas and must help work to eradicate these injustices. They should actively support initiatives that seek to prevent fistulas and should work to remove barriers that hinder access to emergency obstetric care.

VIII. SUMMARY AND GOALS FOR FUTURE RESEARCH

The number of patients with obstetric fistulas in Africa cannot be estimated accurately at this time, but all authors agree that the number is high and that several million women may be affected by this terrible condition. Lack of adequate facilities for fistula repair prevents reduction of the backlog of women currently suffering with fistulas. Lack of adequate access to emergency obstetric services prevents the elimination of new fistula cases.

There is much that still needs to be learned about the optimal care for women with obstetric fistula. There is a great need for further research on both the best treatment of fistulas as well as on the types of programs that will be most effective in preventing fistulas from developing in the first place. There is almost no reliable data on how to develop and implement programs to rehabilitate women who have sustained a fistula and how to reintegrate them into their societies.

Repair of simple fistulas has a high success rate if the operation is performed by a trained surgeon. In cases of this kind, use of a Martius flap may not be required.

Complex fistulas remain challenging, sometimes daunting. A high proportion of women with complex fistulas will have persistent incontinence despite successful fistula closure. The number of women who will suffer from stress incontinence after successful fistula closure can probably be reduced by performing some type of autologous sling operation at the time of fistula repair. Exact protocols for doing this need to be developed.

In addition to their fistula, many patients also suffer from other components of the obstructed labour injury complex involving urological, gynaecological, gastrointestinal, musculoskeletal, psychological and social injuries. These comorbidities must also be taken into account during treatment planning.

The literature on fistulas in the developing world consists primarily of retrospective observational studies. Many fistula surgeons work for charitable organisations whose ultimate goal is the care of patients. Many surgeons are involved in fistula surgery only during short-term trips and leave without having any good idea about patient follow-up or the outcome of surgery. The organization of research in this field is therefore often complicated.

The development of partnerships between charitable organizations and academic institutions could help alleviate this problem. Joint programs between Western academic centres and local African hospitals would not only have a positive influence on the training and scientific expertise of the local staff, but would also be likely to improve the standard of care provided to patients. Several areas for future research can be suggested:

- Health economic studies
- Health organisation studies
- Studies on techniques for fistula closure and related surgical issues
- Urodynamic studies of patients following successful fistula closure
- Studies on long-term outcome, social reintegration, and the effect of fistulas on family life and child health

IX. RECOMMENDATIONS

All recommendations are based on articles with level of evidence 3 or 4. Hence all recommendations have grade C.

- Patients with vesicovaginal fistula should be treated as a person, and they deserve the right to adequate counselling and consent to the treatment they will eventually undergo, despite language and cultural barriers that may exist.
- Surgeons embarking on fistula surgery in the developing world should have appropriate training in that setting and should be willing to take a long-term commitment.
- Prevention of fistula is the ultimate goal. Collaboration between fistula initiatives and maternal health initiatives must be stimulated.

ASSESSMENT

- It is important to make a distinction between simple fistula, which have a good prognosis and complex fistula, which have a less favourable outcome.
- Careful clinical examination will allow the distinction between both types of fistula, although no generally accepted classification system is available. Key items are the size and location of the fistula, the eventual involvement of the urethra and the urethral closure mechanism and the amount of vaginal scarring.
- Associated pathologies should be actively searched for and should be taken into account in the treatment plan: all components of the 'obstructed labour injury complex' should examined.

TREATMENT

- The treatment for vesicovaginal fistula is surgical.

SIMPLE FISTULA

- A vaginal approach is preferred, since most simple fistula can be reached vaginally and since spinal anaesthesia carries less risk than general anaesthesia needed for an abdominal approach necessitating. A trained surgeon should be able to manage these simple fistulas.
- After wide dissection a tension-free single layer closure of the bladder wall and closure of the vaginal wall in a separate layer are advocated. A Martius flap in primary simple obstetric fistula repair is not recommended.
- A care program for failed repairs and for persisting incontinence after a successful repair needs to be installed.

COMPLEX FISTULA

- Complex fistula should be referred to a fistula expert in a fistula centre.
- In principle most complex fistula can be dealt with by vaginal approach, but an abdominal approach can be useful in some cases (e.g. concomitant reconstructive procedures). Advanced training and surgical skills are prerequisites for treating this type of fistula.
- If the urethra and/or the urethral closure mechanism is involved a sling procedure, using an autologous sling, should be performed at the same time as the fistula correction. There is no place for synthetic sling material in that setting.

AFTER CARE

- The majority of patients with as simple fistula will be cured after the repair. A proportion of them and an even larger proportion of the patients after complex fistula repair will remain incontinent. Depending on the local possibilities an after-care program should be installed.

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