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AGE DEPENDENT NORMAL VALUES OF MAXIMUM FLOWRATE, ISOVOLUMETRIC BLADDER PRESSURE AND PROSTATE VOLUME IN 827 ASYMPTOMATIC MALES.

Hypothesis / aims of study

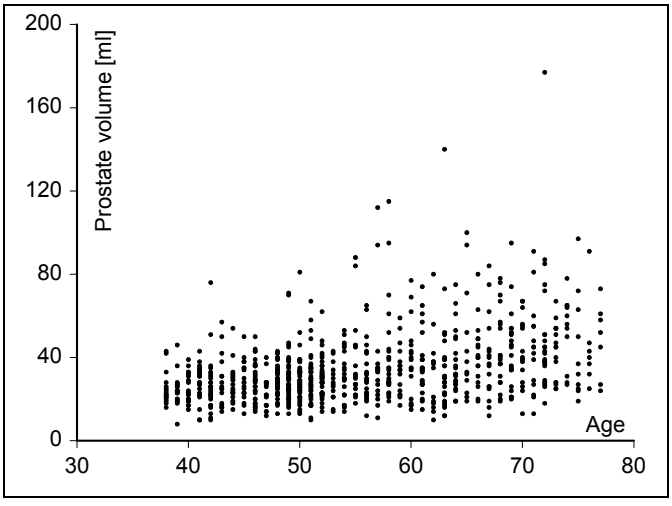
In earlier work, we studied the age dependence of the urinary bladder contractility in 291 female and 225 male patients of mixed pathology [1]. We concluded that the maximum contractility in females decreased almost linearly with age. In males this trend was markedly less pronounced, probably as a result of bladder compensation in response to outflow obstruction. Presently we measured in 827 asymptomatic males the age dependence of normal values for prostate volumes, the maximum flowrate, and the non-invasively measured isovolumetric bladder pressure. The latter may be considered a measure for the urinary bladder contractility.

Study design, materials and methods

Between November 15, 2001 and December 12, 2003, we non-invasively studied 1020 men. The recruitment procedure and inclusion and exclusion criteria have been described before [2]. The men voided in a flowmeter, at a sensation of full bladder. If the maximum flow rate did not exceed 5.4 ml/s, they were excluded. Subsequently the isovolumetric bladder pressure was measured non-invasively, using the condom catheter method [2]. In between the measurements the IPSS was completed. Prostate volume was estimated by transabdominal ultrasound. For the present analysis all men with an IPSS ≥ 10 were excluded. The remaining men were stratified in 8 age groups of 5 years. Mean and standard deviation and 5 and 95 percentiles were calculated for the prostate volume, the maximum flow rate and voided volume of the free flow rate measurement, and the isovolumetric bladder pressure, in each of the 8 age groups. One way analysis of variance was used to test if the variables depended on age.

Results

827 males had an IPSS <10.



The top line of the table shows that there was an even distribution over the 8 age groups, with two exceptions (this was intentional in the study design). The figure shows the distribution of the prostate volumes. It is best described by stating that the **range** of the prostate volumes increased with age. The table shows that the 5th percentile of the volumes increased from 11 to 24 ml, whereas the 95th percentile increased from 43 to 83 ml, between the ages of 38 and 77. As a result, the mean prostate volume increased from 26 to 46 ml. A similar (but decreasing) pattern was seen for the maximum flowrates. There was also a decrease in the range of voided volumes, but this was smaller. These three changes were significant according to the analysis of variance ($p<0.005$). There was no significant change in the isovolumetric bladder pressure ($p=0.75$).

Interpretation of results

We found that with increasing age, the range of normal prostate volumes increased in asymptomatic men. In contrast, the urinary bladder contractility (on average) remained

remarkably constant : In all age groups, the isovolumetric bladder pressure, which may be considered a measure for contractility, ranged from approximately 50 to 160 cm H_2O. The low boundary may have been determined by excluding males with a maximum flow rate < 5.4 ml/s in our study. Earlier we concluded, that as in females urinary bladder contractility

Variable	Parameter	Age →	38-42	43-47	48-52	53-57	58-62	63-67	68-72	73-77
N			102	99	202	92	95	94	92	51
Prostate volume [ml]	5%		11	14	16	15	16	16	20	24
	mean		26	28	30	33	37	39	46	46
	stand dev		9	10	11	17	18	21	23	18
	95%		43	50	48	72	75	81	86	83
Maximum flowrate [ml/s]	5%		8	8	9	8	7	7	6	5
	mean		22	19	19	17	17	15	16	14
	stand dev		10	8	8	7	7	7	7	7
	95%		43	38	35	29	32	28	30	30
Voided volume [ml]	5%		93	95	89	132	106	98	114	78
	mean		379	342	340	342	357	320	297	259
	stand dev		225	189	196	170	179	166	140	163
	95%		800	706	715	679	645	628	540	668
Isovolumetric bladder pressure [cmH_2O]	5%		49	62	57	54	60	54	57	37
	mean		104	101	101	98	104	105	105	101
	stand dev		32	29	30	29	32	28	30	34
	95%		164	156	153	159	158	150	158	160

decreases with age [1], one explanation for the age independence of male contractility may be that compensation in some subjects is balanced by decompensation in others, resulting in an unchanged average. However, in the present study the subjects were asymptomatic (IPSS < 10), so that we would have to assume that bladder compensation took place without symptoms, or that compensation prevented the symptoms. An alternative explanation is that in the tested population bladder compensation did not occur, and that the age independence of male bladder contractility is inherent. However, (the range of) maximum flowrates decreased significantly with age, so that there definitely seemed to be a trigger for compensation. Although voided volumes also decreased significantly, it is unlikely that this caused the decrease of flow rate. Not only was the decrease in voided volumes too small to explain the decrease in flow rates, but also it was shown that when multiple flow rate measurements are done in one subject, maximum flowrates are independent of the voided volume, above a certain threshold [3]. As the subjects in the present study all voided at a sensation of full bladder, voided volumes were considerable.

Concluding message

The table shows age dependent normal values for prostate volumes, maximum flowrates and isovolumetric bladder pressures in 827 asymptomatic males. The range of the prostate volumes increased significantly with age, and that of the flowrates decreased. The bladder pressure remained constant, as we earlier found in a smaller invasive study. The combined evidence makes it debatable if bladder compensation occurred in this population. That will be tested by a follow up study.

References

[1] Age dependence of urinary bladder contractility. Neurourol.Urodyn.11-4 : 315-317 (1992).
[2] Applicability and reproducibility of the condom catheter method for measuring the isovolumetric bladder pressure**.** Urology 63 : 56-60 (2004).
[3] Measurement and analysis of voided volumes using a small electronic pocket balance. Sc.J.Urol.Nephrol.30 : 257-263 (1996)

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