

A STUDY OF HUMAN CADAVERIC URETER BY SIMPLE DISSECTION METHOD

Banani Deka ^{*1}, Rubi Saikia ².

^{*1} Demonstrator, Department of Anatomy, Gauhati Medical College and Hospital, Guwahati, Assam, India.

² Associate Professor, Department of Anatomy, Jorhat Medical College and Hospital, Jorhat, Assam, India.

ABSTRACT

Aim: To study the major anatomical variations of the ureter by simple dissection method.

Materials and Methods: Present study conducted on the ureters collected from thirty formalin fixed human cadavers by simple dissection method. The ureters were followed from the renal pelvis up to the opening into the urinary bladder. Some of the very important variations were observed during the study.

Results: Among 30 cadavers, 3(10%) cadavers presented with variations of the renal pelvis and ureter. 3(5%) nos. of specimens showed presence of megaureter. 1(1.67%) specimen presented with incomplete duplication of ureter (bifid ureter) at renal pelvis. Of these 2(3.3%) specimens were unilateral and 2(3.3%) specimens were observed with bilateral variations of ureter. **Conclusion:** Knowledge of anatomical variations of urinary system is of great importance as it can affect both the disease conditions as well as the interventional methods.

KEY WORDS: Ureter, Renal pelvis, Megaureter, Bifid Ureter, Incomplete and complete duplication of ureter, Duplex system, Unilateral, Bilateral.

Address for Correspondence: Dr. Banani Deka, Demonstrator, Department of Anatomy, Gauhati Medical College and Hospital, Guwahati, Assam, India. **E-Mail:** dekabanani12@gmail.com

Access this Article online

Quick Response code



DOI: 10.16965/ijar.2016.393

Web site: International Journal of Anatomy and Research
ISSN 2321-4287
www.ijmhr.org/ijar.htm

Received: 31 Aug 2016

Peer Review: 01 Sep 2016

Revised: None

Accepted: 29 Sep 2016

Published (O): 31 Oct 2016

Published (P): 31 Oct 2016

INTRODUCTION

Ureters are two muscular tubes that extend from the renal pelvis to the posterior surface of the urinary bladder whose peristaltic contractions convey urine from the kidneys. Each measuring 25-30cm in length, the ureters are thick walled and are continuous superiorly with the funnel shaped renal pelvis. The diameter of ureter is 3mm normally but it is little less at the junction with renal pelvis, at the pelvic brim and within the wall of the urinary bladder. The ureter passes obliquely through the wall of the bladder for about 1.9 cm before opening into the urinary

bladder. Ureters descend slightly medially anterior to psoas major and enter the pelvic cavity laterally then medially to open into the base of the urinary bladder. Near its termination in males it is crossed by the vas deferens and by the uterine artery in females. Therefore anatomical and structural variations of ureter are important in surgical, radiological and academic perspective [1,2].

Embryologically ureters develop from the ureteric bud, a diverticulum from the mesonephric duct, metanephric diverticulum at around 3rd week of intrauterine life. The stalk of the

metanephric diverticulum forms the ureter and the cranial portion of the diverticulum undergoes repeated branching to form the major and minor calyces [3].

MATERIALS AND METHODS

The study is an observational descriptive type, carried out in the dissected cadavers to explore the presence of any anatomical variations in renal pelvis and ureter. The study was carried out in the Department of Anatomy, Assam Medical College and Hospital, Dibrugarh, Assam (2013-2015). After obtaining ethical clearance from the Ethical Committee of AMCH, Dibrugarh, kidneys of 30 formalin fixed human cadavers (60 specimens) of either sex were studied by blunt dissection method to see the ureter and the renal pelvis. Among them adult cadavers were 10 in number (20 specimens) and 20 were perinatal cadavers (40 specimens). Perinatal cadavers were stillborn fetuses collected from Department of Obstetrics and Gynaecology, AMCH, Dibrugarh. Among 30 cadavers 23 were males and 7 were females.

Dissection procedure was followed from Grant’s Dissector, 15th edition, using scalpel, scissors, blunt and toothed forceps, needle etc. The kidneys were exposed along with ureters from pelvis to the opening into the urinary bladder as described in the Grant’s dissector [4].

Inclusion and exclusion criteria: All the specimens were included in the study except the specimens which were putrefied. Specimens which showed crush and cut injury of ureter were excluded from the study.

RESULTS

Table 1: Showing the prevalence of ureter among specimens expressed in percentage.

Total no. of specimens observed	Normal ureter	Ureters with variations present	Percentage (%) of normal ureter	Percentage (%) of variations
60	56	4	93.3	6.7

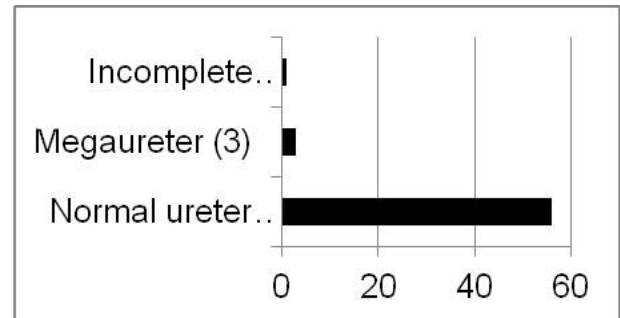
Table 2: Showing the unilateral and bilateral variations among specimens expressed in percentage

Total no. of specimens	Unilateral ureteric variations	Bilateral ureteric variations	Percentage (%) of unilateral ureteric variations	Percentage (%) of bilateral ureteric variations
60	2	2	3.33	3.33

Table 3: Showing different types of variations of ureter among specimens expressed in percentage.

Total no. of specimens	No. of megaureter	Percentage of megaureter (%)	No. of incomplete bifid ureter	Percentage (%) of incomplete bifid ureter
60	3	5	1	1.67

Graph 1: Bar diagram showing different types of variations of ureter.



The results of the observations made on the dissected bodies are discussed below. 56(93.3%) nos. of specimens were observed with normal ureter and renal pelvis. Whereas 4(6.7%) specimens presented with variations of the renal pelvis and ureter. Of these 2(3.3%) specimens presented with unilateral variations and 2(3.3%) specimens showed bilateral variation of ureter.

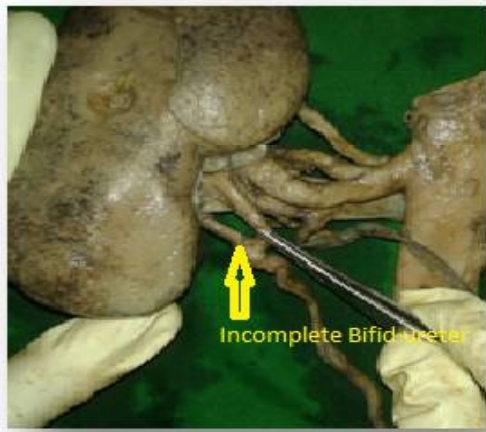
Fig. 1: Left sided mega pelvis on posterior view.



Fig. 2: Bilateral mega ureter on posterior view.



Fig. 3: Left sided incomplete bifid ureter on posterior view.



DISCUSSION

Aim of this study was to document presence of any major anatomical variations of ureter. The anatomical variations of ureter are not uncommon. Megaureter, incomplete or complete duplications are some reported variations that have been known since ages. Incomplete duplication of ureter is known as bifid ureter, this kind of variation may be formed due to some error or disturbance in development of the ureteric bud which arises from the mesonephric duct. [5] In 1989 Asakawa M et al reported five cases of double pelvis and ureter among 340 cadavers (1.47%, 1.8%R, 0.3% L). [6] In the present study the incidence of left sided incomplete bifid ureter was 1.7% which was almost similar with the findings of Asakawa M et al.

The ureter was bifid at hilum which was united to form single ureter about 2 cm distally. Genitourinary system development begins with the formation of the pronephros and mesonephros within intermediate mesoderm. A series of mesenchymal epithelial interactions leads to the development of the Wolffian duct, which elongates caudally to fuse with the cloaca (the precursor of the bladder and urethra). The distal part of the Wolffian duct receives signals from the adjacent metanephric mesenchyme to induce ureteric bud formation. The principle signaling pathway, involves glial cell line-derived neurotrophic factor (GDNF) ligand expression from adjacent metanephric mesenchyme, interacting with Ret/GFR α 1 receptor complex located on the Wolffian duct epithelium [7].

Clearly to induce ureteric bud formation at the appropriate region, GDNF expression within the

metanephric mesenchyme must be restricted. In animal models, loss of function of transcription factors which repress GDNF expression in adjacent mesenchyme, lead to duplex/multiplex urinary collecting systems [7]. Unrestricted signalling to the Wolffian duct may elicit formation of multiple ureteric buds, leading to multiplex/duplex collecting systems. However, the molecular signalling defects underlying duplex collecting systems, is not completely understood. Once the ureteric bud penetrates the metanephric mesenchyme, continues to branch within the substance of the metanephric mesenchyme to form the collecting system.

The remaining ureteric bud between the Wolffian duct and the metanephric mesenchyme forms the ureter. Premature branching prior to entering the substance metanephric mesenchyme is thought to account for the formation of bifid ureters. The ureters may remain separate throughout their course, entering the bladder by two distinct ureteric orifices which is referred as complete duplication. Fusion of the ureters along their length is referred to as either bifid systems or bifid ureters, depending on whether the ureters fuse proximally or distally. A. Jayasekera et al reported a case of a duplex urinary collecting system that forms a single chamber about 2 cm proximal to the bladder with distal bifurcation and drainage into the bladder via distinct ureteric orifices. [8] Duplex systems are the most commonly encountered congenital abnormality of the renal tract, with a reported incidence of 0.8% [9]. However Standring S et al has described the incidence of unilateral bifid ureter as 1 in 125 [1]. Congenital megaureter is characterized by giant focal segmental ureteral dilatation producing an elongated and distorted ureter; distally there may be congenital ureteral stenosis or atresia. [10] Unlike congenital megaureter which might be observed bilaterally in about 20 % cases [11]. Out of the 27 patients with CGM, 14 megaureter were on the left side and 13 were on the right side as reported by Mingming Yu et al. [12] In the present study a case of left sided megaureter at pelvis was present with no visible obstruction distally. Bilateral megaureter with cystic kidneys was present in a fetal cadaver. So the incidence of

megaureter was 6.67% in the present study. Bilateral and unilateral megaureter in our study was 3.3% and 3.3% respectively. However the incidence in relation to the gender could not be calculated as the male cadavers outnumbered the female cadavers.

CONCLUSION

In the present study we have observed some of the very rare anatomical variations of the ureter. Many authors till now have come across such variations and have given explanations from embryological point of view. Adult and adolescent primary obstructive megaureter is a congenital abnormality that does not regress. Complications such as stone formation, altered function of the affected kidney are common and are associated with recurrent urinary tract infections which require surgical intervention [13]. Incomplete duplication of ureter has very rare incidence and clinically also less significant and often found to be asymptomatic. It has a propensity for vesicoureteral reflux into the lower pole and obstruction of the upper pole, which can be problematic [14].

Duplex collecting systems can be associated with a variety of congenital genitourinary tract anomalies [15]. Patients with double ureters may be accompanied by other ureteral anomalies such as ectopic ureter, have an increased risk of developing urinary tract infection, pain, hydronephrosis and stone formation [16]. Very rarely a case of squamous cell carcinoma of the renal pelvis associated with an incompletely duplicated renal pelvis and ureter has been so far reported [17]. A good knowledge and proper documentation of such variations will help in the diagnosis and treatment of various genitourinary diseases.

ACKNOWLEDGEMENTS

I want to thank my husband Dr. Partha P Saikia for his help and support to carry out this work. I am grateful to Dr. Giriraj Kusre for his unconditional encouragement for research.

Conflicts of Interests: None

REFERENCES

- [1]. Standring S. Gray's Anatomy, 40th Edn, Churchill Livingstone, Elsevier, 2012, 1238-1243.
- [2]. Rahabu Marwa MORRO, George Joseph LUFUKUJA, Flora M FABIAN, Bilateral double ureters and accessory renal vessels in a Tanzanian male cadaver: a rare urinary system variation, *International Journal of Anatomical Variations* 2011;4:164-166.
- [3]. Moore K L, Persaud TVN. *The Developing Human, Clinically Oriented Embryology*, 8th Edn, New Delhi, Elsevier. 2011;244-245.
- [4]. Grant's Dissector 15th Edn, Lippincott Williams & Wilkins, New Delhi, 2013:116-119.
- [5]. Summers JE. V. Double ureter. Report of a nephrectomy done upon a young child with this condition present. *Ann Surg.* 1901;33:39-41.
- [6]. Asakawa M, Kubodera T, Okamura Y, Habara K, Ito H, Five cases of the double renal pelvis and ureter, *Kaibogaku Zasshi*, 1989 Jun;64(3):206-9
- [7]. Uetani N, Bouchard M. Plumbing in the embryo: developmental defects of the urinary tracts. *Clin Genet* 2009;75:307-17 [PubMed]
- [8]. Jayasekera A, Tempest H, Kumar S. An H-shaped complete ureteric duplication: embryology or erosion. *BMJ case reports.* 2011 Jun 9;2011:bcr0220113867.
- [9]. Privett JT, Jeans WD, Roylance J. The incidence and importance of renal duplication. *Clin Radiol* 1976;27:521-30 [PubMed].
- [10]. Cheng-Ju Huang¹, Peking, China, ¹From the Department of Surgery, Peking Children's Hospital, Peking. *Journal of Paediatric Surgery*, March 1987;22(3):235-239.
- [11]. Hemal A, Ansari M, Doddamani D, Gupta N. Symptomatic and complicated adult and adolescent primary obstructive megaureter—indications for surgery: analysis, outcome, and follow-up. *Urology.* 2003;61:703-7.
- [12]. Mingming Yu, Geng Ma, Zheng Ge, Rugang Lu, Yongji Deng and Yunfei Guo: Unilateral congenital giant megaureter with renal dysplasia compressing contralateral ureter and causing bilateral hydronephrosis: a case report and literature review, *BMC Urology BMC series – open, inclusive and trusted* 2016;7 DOI: 10.1186/s12894-016-0125-y © Yu et al. 2016.
- [13]. Solinas A1, Pau A, Ayyoub M, Frongia M, Primary obstructive megaureter in adults: management strategy in a young woman. *Arch Ital Urol Androl.* 2010 Sep;82(3):192-4.
- [14]. Gatti JM. Ureteral Duplication, Ureteral Ectopia, and Ureterocele. <http://emedicine.medscape.com/article/1017202-overview> (accessed March 2011).
- [15]. Lee S, Kim W, Kang KP, Jeong YB, Kim YK, Jang YB, Park SK. Bilateral incomplete double ureters. *Nephrol Dial Transplant*, 2007;22:2720-2721.
- [16]. Inamoto K, Tanaka S, Takemura K, Ikoma F. Duplication of the renal pelvis and ureter: associated anomalies and pathological conditions. *Radiat Med* 1983; 1: 55-64.
- [17]. Ogawa M1, Morikawa T1, Toyoshima T2, Fukayama M, Squamous cell carcinoma in a duplicated renal pelvis. *Int J Clin Exp Pathol.* 2014 Oct 15;7(11):7957-61. e Collection 2014.

How to cite this article: Banani Deka, Rubi Saikia. A STUDY OF HUMAN CADAVERIC URETER BY SIMPLE DISSECTION METHOD. *Int J Anat Res* 2016;4(4):3005-3008. DOI: 10.16965/ijar.2016.393