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## Case Report

# Bifid ureter with blind-ending branch: A rare anatomic variant detected during antegrade ureteric stent insertion

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### ABSTRACT

Anatomic variants of the urinary tract are relatively common; however, a bifid ureter with a blind-ending branch is a rare congenital anomaly. This variant often goes unnoticed because patients are either asymptomatic or complain of vague abdominal symptoms. Diagnosis is often incidental, and may be missed on conventional imaging. Although bifid ureters usually do not require any specific investigations or treatment; it is important to have an appreciation for these anomalies particularly if radiological intervention or surgical procedures are planned. We describe a case of a blind-ending bifid ureter in a patient with bilateral hydronephrosis secondary to a large cervical malignancy. The presence of the bifid ureter was only appreciated during a technically challenging antegrade ureteric stent insertion several weeks after diagnosis. We review the clinical significance, embryology, and radiology findings of this anomaly, as well as the implications during radiological interventional procedures.

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## Case Report

A 56-year-old postmenopausal woman initially presented to her general practitioner (GP) with a 1-month history of deep seated pelvic ache and increased urinary frequency with recent onset of light vaginal bleeding. A bimanual examination revealed an irregular cervical lump. Subsequently, a

smear test was performed with an urgent referral to the gynecology team for further assessment. Her initial colposcopy examination revealed a mass replacing the vaginal vault with abnormal cervical tissue confirmed as a poorly differentiated squamous cell carcinoma (SCC) on biopsy. Pelvic magnetic resonance imaging (MRI) confirmed a locally advanced cervical tumor with extension into the uterus, parametrium, posterior bladder wall, lower one-third of the vagina, uterosacral

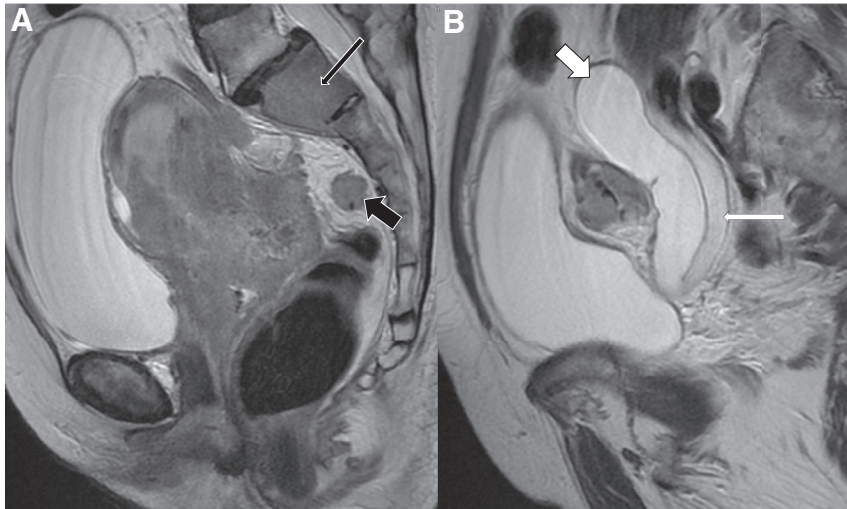
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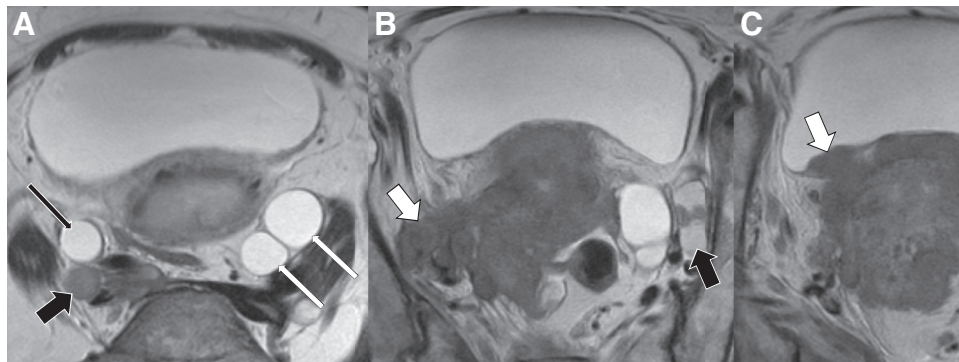
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**Fig. 1 – (A)** Sagittal T2-weighted MRI images showing a large locally advanced cervical tumor with extension into the uterus, parametrium, and lower third of the vagina. There is an enlarged presacral lymph node (thick black arrow) and an S1 vertebral deposit (thin black arrow). **(B)** Para-sagittal T2-weighted MRI images showing the bifid left ureter with the blind-ending branch (thick white arrow) anterior to the dilated main ureter (thin white arrow). In this case, there was a single ureter exiting the left kidney. The bifid blind-ending branch had a distal origin from the main ureter close to the ureteric orifice in the bladder. This branch extended cranially measuring 10 cm in length. MRI, magnetic resonance imaging.



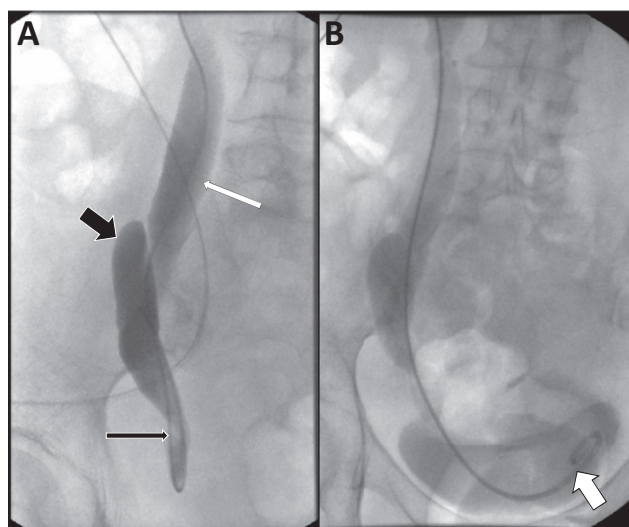
**Fig. 2 – (A)** Axial oblique T2-weighted MRI at the level of the uterine fundus showing bilateral hydronephrosis, single on the right (thin black arrow), and bifid on the left (thin white arrows). An enlarged right common iliac lymph node is also noted (thick black arrow). **(B)** Axial oblique T2-weighted MRI at the level of the internal os showing extension of the cervix tumor to the right pelvic sidewall with encasement of the internal iliac vessels (thick white arrow) and a necrotic left pelvic sidewall lymph node (thick black arrow). **(C)** Axial oblique T2-weighted MRI at the level of the mid cervix showing circumferential tumor extension into the parametrium and posterior bladder wall (thick white arrow); with an enlarged presacral lymph node (thick black arrow). MRI, magnetic resonance imaging.

ligaments, and pelvic sidewall with involvement of the distal ureters and iliac vessels (International Federation of Gynecology and Obstetrics (FIGO) staging system Stage 4B; [Figs. 1](#) and [2](#)). She was admitted to hospital shortly after diagnosis for management of the bilateral hydronephrosis with nephrostomies prior to commencing chemotherapy.

Following her second cycle of chemotherapy, she was referred for bilateral ureteric stent insertions. Despite multiple attempts, the right-sided obstruction could not be manoeuvred and the nephrostomy remained in place. During the stent insertion on the left side, a blind-ending tubular structure was noticed which filled with contrast during the

ureterogram which was subsequently found to be a blind-ending bifid ureter with a distal origin ([Figs. 3](#) and [4](#)). Despite a successful ureteric stent insertion, it was a technically challenging procedure with guide wires preferentially tracking into the blind-ending branch. On retrospective review of the initial MRI, this bifid ureter was also demonstrated but initially thought to be a convoluted left ureter as a result of the hydronephrosis.

She completed 6 cycles of chemotherapy with clinical improvement; however, post-treatment staging imaging revealed progression of disease with peritoneal lymphadenopathy, omental disease, and growth of the primary tumor. A decision was made to continue radical treatment.

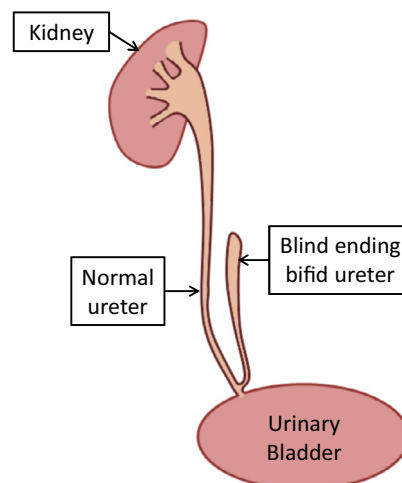


**Fig. 3 – (A and B) Left-sided ureterogram performed during antegrade ureteric stent insertion showing a contrast-filled obstructed left ureter (thin white arrow). The guide wire (thin black arrow) is seen tracking into a tubular structure with a distal origin which is the blind-ending bifid ureter (thick black arrow). The access into the urinary bladder was obtained with a 4Fr Vertebral catheter (4Fr, 80 cm—Merit Medical) and a standard hydrophilic guide wire (0.035 in., Angled tip—Merit Medical) under fluoroscopy guidance. Although the guide wire was prone to get into the blind-ended branch, some standard manipulations with the catheter and the wire were adequate to advance the guide wire into the urinary bladder. A 7Fr JJ antegrade ureteric stent (7Fr x 26 cm—Bard Medical) was inserted through a peel away sheath with a standard technique and without any specific difficulties. Following successful navigation through the distal obstruction and bifid ureter, the ureteric stent (thick white arrow) was placed into the urinary bladder.**

Shortly after her restaging review, she was admitted to hospital with severe sepsis from a urinary tract source. Unfortunately, she deteriorated rapidly during her admission and subsequently died from complications.

## Discussion

There are a wide range of congenital anomalies of the urogenital tract [1]. A bifid ureter is an uncommon anatomic variant that results from an incomplete duplication of the renal collecting system [2]. In most cases, it is associated with a duplex kidney with unification of the ureters before draining into the bladder through a single orifice. Rarely, 1 of the ureters fails to unite with the pelvicalyceal collecting system resulting in a blind-ending branch (Fig. 4). This specific variant has been reported to be more common in women, and more often present on the right side [3]. Blind-ending bifid ureters can be further distinguished into subtypes depending on the origin of the



**Fig. 4 – Illustration detailing the configuration of the blind-ending bifid ureter in the case presented. A single ureter exits the kidney through a normal renal pelvis. Distally, just before the vesicoureteric junction, the ureter divides with a blind-ending branch extending cranially alongside the normal ureter. The ureter connects to the bladder through a normal single ureteric orifice.**

branch, namely proximal, middle, or distal. It has been suggested that the middle blind-ending bifid ureters are the least common subtypes [3].

In normal embryologic development, the ureteric bud is an invasive epithelial tubule that arises from the mesonephric (Wolffian) duct at around day 28 of gestation [4]. The ureteric bud is the precursor for the renal collecting system and branches into surrounding metanephric blastema. Once these structures unite, the metanephric tissue eventually forms the filtration structures of the developed kidney and the trunk of the ureteric bud becomes the ureter. In abnormal embryogenesis, the ureteric bud may divide into 2 branches. If the additional branch reaches the metanephric blastema then this forms a complete duplication. If the additional branch fails to reach the metanephric blastema then then this forms a blind-ending ureter or incomplete duplication [2,4].

Blind-ending bifid ureters are typically incidental findings and the majority of patients are asymptomatic. Despite this, symptoms may include abdominal pain and recurrent urinary tract infections. These symptoms may be accounted for by inflammation of the blind-ending branch and peristaltic disturbances caused by uretero-ureteric reflux [2]. Other associations may include stone formation and vesicoureteric reflux [2,5,6]. Most cases are diagnosed during common urological investigations such as intravenous urography, retrograde pyelography, or diagnostic cystoscopy. Computed tomography and MRI are also capable of detecting these anomalies, but this is dependent on the scan protocol that is used [6,7]. In particular, the value of multidetector computed tomography imaging using multiplanar reformats and 3D reconstructions to establish the diagnosis has been described in the literature. This allows a detailed evaluation of the anatomy of the urinary system and exclusion of other possible etiologies [7].

In the case described, the blind-ending bifid ureter could be seen on the presenting MRI and taken to represent a convoluted distal ureter proximal to the obstructing cervical tumor. It was only during the attempted antegrade ureteric stent insertion several weeks after initial diagnosis that it was recognized after presenting a technical challenge while passing the obstruction in the distal ureter. Navigating through tight distal ureteral obstructions under fluoroscopic guidance can be difficult [8,9]. In the presence of an anatomic anomaly such as a bifid ureter with a distal origin, this presents a tougher challenge, and recognizing this uncommon variant is therefore important for both diagnostic and interventional radiologists if longer fluoroscopy screening time and the use of more contrast media is to be avoided.

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