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Duplication of Gallbladder Amidst Out of the Ordinary Associated Anomalies

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Dear Editor, we present a case of a duplicated gallbladder (GB) with exceptionally rare associated anomalies, along with the existing literature about this variant, its anatomical categorization, and surgical implications. There are numerous varying subtypes of GB duplication and their knowledge is essential for diagnosis and surgical management.

The GB is known for its anatomical variations. Duplication of GB is one such rare congenital entity, with incidence of 1 per 3,800 to 4,000 births.[1] Although it usually presents as an incidental finding associated with other congenital anomalies, a preoperative diagnosis is important to prevent iatrogenic bile duct injuries during cholecystectomy, especially in the present era of laparoscopic or minimal access surgeries. Ultrasound (USG) is the preferred imaging modality because of its high sensitivity and specificity.

A 1-year-old female child, diagnosed with ventricular septal defect (VSD), was referred to the department of radiodiagnosis for USG abdomen, which revealed two elongated anechoic cystic structures in GB fossa region, suggestive of duplication of GB (►**Fig. 1**). Also, left renal pelvis was disproportionately dilated as compared with renal calyces, with abrupt narrowing at the pelvic-ureteric junction (PUJ), suggestive of PUJ obstruction. VSD was also demonstrated on USG and Doppler imaging (►**Fig. 2**). Subsequently, magnetic resonance cholangiopancreatography (MRCP) was performed which revealed two separate GBs opening into common cystic duct and left PUJ obstruction was confirmed. Hepatobiliary iminodiacetic acid scan was also performed which confirmed the presence of double GB. Final diagnosis of Y-shaped type (vesica fellea duplex) duplication of GB with left-sided PUJ obstruction kidney was made.

The duplication of GB is a morphological anomaly. It occurs due to incorrect differentiation or abundant division of embryonic organs during the 5th and 6th gestational week, when the caudal bud of the hepatic diverticulum divides into different buds or outpouchings. The later the single primordium divides, the less outright is the resulting duplication. Consequently upon, a true duplication of GB occurs earlier in the gestation and involves the existence of an accessory GB and two distinct cystic ducts.[2]

Among the several proposed classification systems, Boyden's system is used to classify duplication of GB. The two main types of duplications are vesica fellea divisa (bilobed GB) and vesica fellea duplex (true duplication), the latter being more frequent, with two separate cystic ducts. However, the true duplication is subclassified into H-shaped type which comprises two separate GBs and cystic ducts entering separately into the common bile duct; and another Y-shaped type, where the two cystic ducts unite before opening into the common bile duct.[3] Adding to our knowledge, cases of triple GBs have also been reported in the literature.[4]

The differential diagnosis includes GB fold, focal adenomyomas, Phrygian cap, intraperitoneal fibrous (Ladd's) bands, choledochal cyst, pericholecystic fluid, and GB diverticulum. Although clinical significance of double GB like association of gallstones, risk of cancer, etc., is alike to those encountered in single GB, preoperative diagnosis is important to avoid bile duct injuries during cholecystectomy.[1]

There have been sporadic case reports of several anomalies associated with double GB including foregut malformations, aberrant hepatic, and mesenteric vessels.[5] However, none of them have reported the association with PUJ and VSD, which makes this case even rarer[6–15] (►**Table 1**).

USG remains the initial choice with high sensitivity and specificity. Contrast-enhanced computed tomography, MRCP, and nuclear imaging are other modalities which can be used to delineate the anatomy. Cholecystectomy is recommended in symptomatic patients; however, surgery in asymptomatic patients remains controversial. Duplication of GB is a rare biliary tract anomaly that should be recognized

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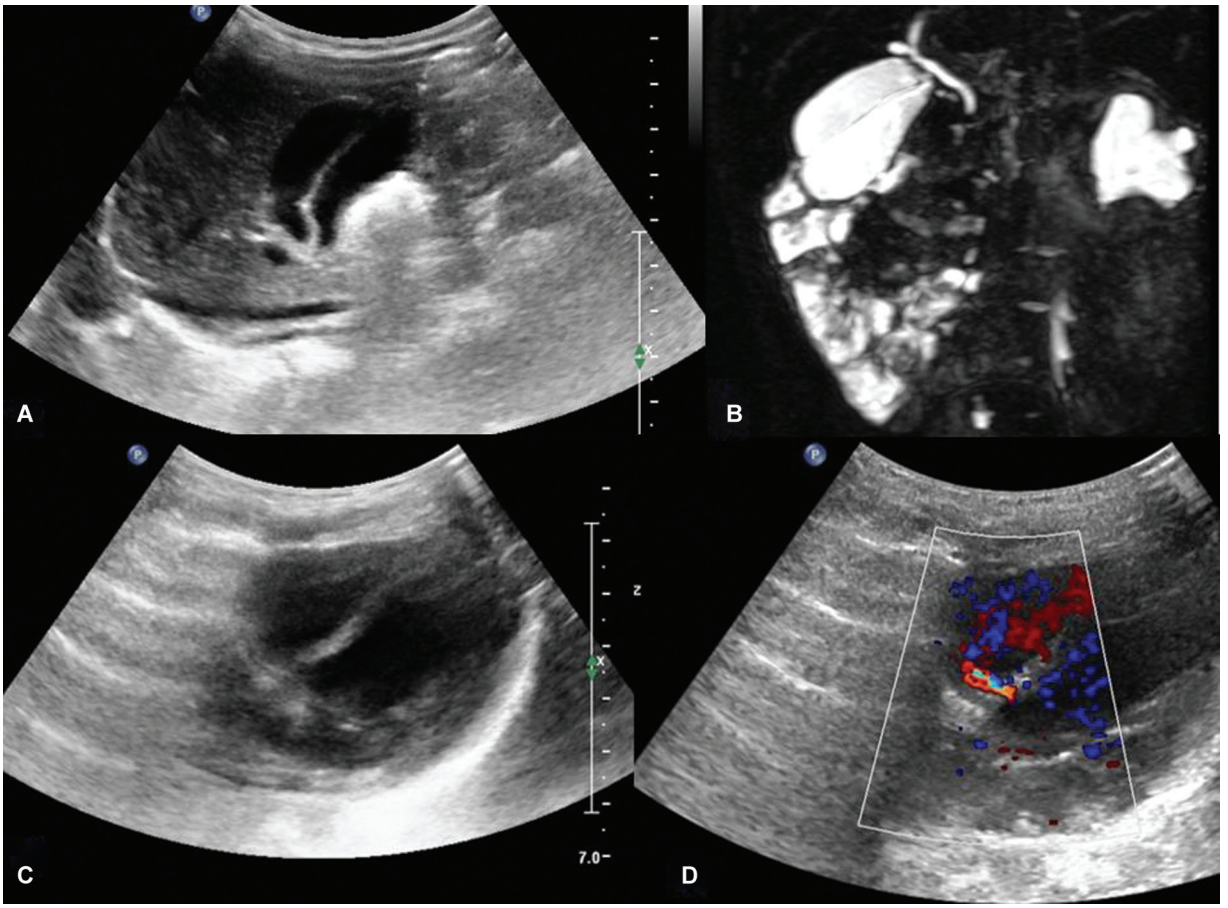

Fig. 1 (**A**) Transabdominal ultrasound (USG) showing two elongated saccular structures of anechoic content at the gallbladder fossa, reflecting duplicated gallbladder. (**B**) Coronal magnetic resonance cholangiopancreatography (MRCP) images showing two pear-shaped structures in the gallbladder fossa suggestive of duplicated gallbladder with common cystic duct draining into the common bile duct (CBD). Left-sided pelvic-ureteric junction (PUJ) obstruction is also seen. (**C**, **D**) USG and Doppler images showing presence of ventricular septal defect.

by the imaging experts to serve as a roadmap for operating surgeon to prevent undesirable operative and postoperative morbidity.

Declaration of Patient Consent

The authors certify that they have obtained all appropriate patient's guardian's consent forms and they have given the images and other clinical information to be reported in the journal. They understand that patient's name and initials will not be published and due efforts have been made to conceal the identity. The research complied with Helsinki Declaration 1964.

Ethics Approval and Consent to Participate

A written approval was obtained from the subject.

Consent for Publication

The authors consented to the submission of the manuscript and publication. The authors disclosed no competing interests and no relevant relationships.

Availability of Data and Materials

The cases and the images are available from the Department of Radiodiagnosis, Vardhman Mahavir Medical College and Safdarjung Hospital, New Delhi, India.

Authors' Contributions

N.B. is the corresponding author, designed and revised the work, interpreted the data, and submitted the case. N.B. has approved the submitted version for publication. A.B. has drafted the work and approved the submitted version for publication. R.M. and A.M. have revised the manuscript and approved the submitted version for publication. No disclosure. All authors read and approved the final manuscript.

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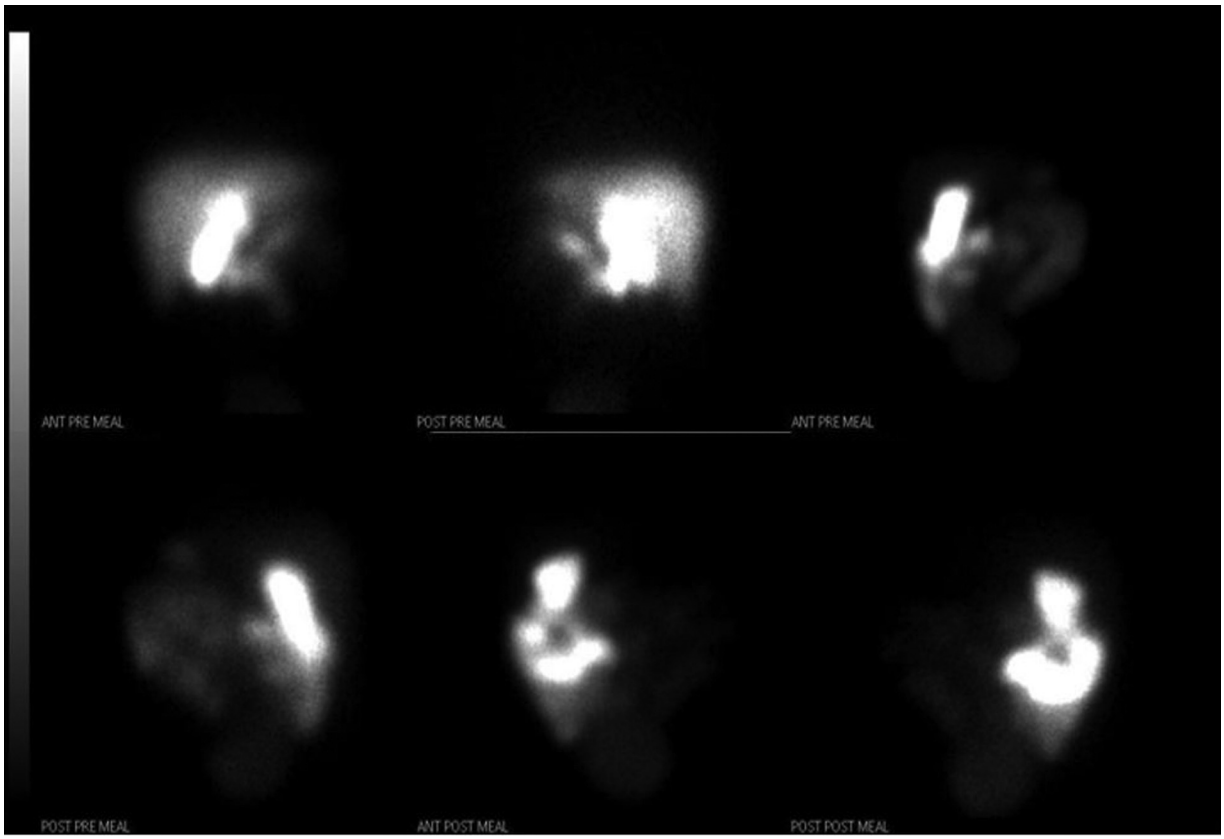

Fig. 2 Serial static hepatobiliary iminodiacetic acid (HIDA) images in anterior, posterior oblique views confirming the presence of duplicated gallbladder (GB).

Table 1 Cases of duplication of gallbladder associated with other anomalies

Sl. no.	Author and year reported	Patient's age and gender	Associated anomalies
1.	Bailie et al, 2003	7 y, female	Heterotopic gastric mucosa
2.	Sasaki et al, 2005	69 y, male	Double gallbladder of the duodenal type
3.	Lefemine and Lazim, 2009	55 y, male	Traumatic neuroma
4.	Kawanishi et al, 2010	75 y, male	Well differentiated tubular adenocarcinoma
5.	Kachare et al, 2013	55 y, female	Ectopic thyroid
6.	Girish et al, 2013	3-day-old, male	Duodenal atresia
7.	Menon et al, 2013	4 y, male	Duodenal duplication cyst
8.	Gupta et al, 2016	2-day-old, male	Gastrointestinal atresia
9.	Gupta et al, 2016	12-day-old, male	Duodenal atresia
10.	Chamaria, 2016	9 y, male	Horse-shoe kidney
11.	Zhuang et al, 2020	61 y, male	Type I choledochal cyst
12.	Kumar et al, 2021	6 y, male	Type I choledochal cyst

Conflict of Interest
None declared.

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