The Importance of Ultrasound Examination in the Studding of the Gall Bladder Anatomic Variations and their Influence in Biliary Dyskinesia

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Abstract

Aim: The aim of this study is to investigate the frequency of the gall bladder shape related of anatomic variations using ultrasound (US) examination and impact on biliary dyskinesia.Materials and Methods: A study population of 1250 subjects, respectively divided as folloing: 7294 (64.8%) hospitalized patients, 3112 (27.7%) ambulatory and 844 (7. 5%) volunteers underwent US examination in the hospital between January 2010 – March 2013. The ultrasound examination was done in order to assess for possible anatomic variations and their influence in biliary dyskinesia. Results: In total 1250 subjects were studied, 92 (0.82%) showed gall bladder anatomic variations related to shape, 33 patients (0.29%) presents with anatomic variations of the construction of the gall bladder, 8 patients (0.07 %) anatomic variations of positioning and 13 patients (0.11%) with anatomic variations of genesis, 53 (36.3%) of the patients with above anatomic variations represented the status of biliary dyskinesia. Discussions: The anatomic variations of the gall bladder are favoring factors of gall stones forming and inflamation. The association with other congenital malformations should increse detailed control of all the elements of the biliary tract. Conclusion: Pointing out these anatomical variations before the surgical intervention may prevent possible iatrogenic traumas. Anatomic variations of the gall bladder may stimulate biliary dyskinesia.

Key words: Anatomic variation, ultrasound, gallbladder, biliary dyskinesia.

Introduction

The gallbladder is a piriform (pear-shaped) organ that straddles the undersurface of segments IVB and V of the liver. It has an inferior peritoneal surface and a superior hepatic surface that is closely applied to the gallbladder bed in the liver. The part of the gallbladder projecting beyond the undersurface of the liver is called the fundus, which continues into the main body of the gallbladder, which lies in a fossa on the undersurface of the liver. On diagnostic imaging modalities, the gallbladder neck is seen in higher cuts (sections) than the gallbladder body, which is seen higher than the gallbladder fundus. The body of the gallbladder narrows into an infundibulum, which leads through the neck to the cystic duct. An inferior sacculation (outpouching) of the gallbladder infundibulum or neck is sometimes present; this is called the Hartmann pouch. The Calot triangle is bounded by the cystic duct on the right, common hepatic duct (CHD) on the left, and undersurface of the liver above; the cystic artery and cystic lymph node lie in the Calot triangle. A peritoneal cholecystoduodenal fold connects the gallbladder neck to the first part of the duodenum.

Functional gallbladder disorder is defined as biliary pain resulting from a primary gallbladder motility disturbance in the absence of gallstones, sludge, microlithiasis, or microcrystal disease. The diagnosis is considered in patients with typical biliary-type pain who have had other causes for the pain excluded. The prevalence of functional gallbladder disorder among patients with biliary-type pain and a normal transabdominal gallbladder ultrasound is up to 8 percent in men and 21 percent in women (1, 2, 3).

In the past, functional gallbladder disorder has been referred to by various names, including gallbladder dyskinesia, gallbladder spasm, acalculous biliary disease, chronic acalculous cholecystitis, chronic acalculous gallbladder dysfunction, and cystic duct syndrome.

Materials and Methods

With the opportunities available, we were initially oriented towards the study, whose methodology was based on the realization of imaging procedures. These procedures are diverse and widely applicable at Service of Radiology, Mother Teresa University Hospital Centre, Tirana, Albania, where the author of the study is employed full time. In general these diagnostic methods include Ultrasound, Cholangiography, CT, Scintigraphy, MRI.

In the complexity of these examinations was preferred Ultrasound. Ultrasound imaging is the method chosen for the study and diagnosis of pathologies of the gallbladder. This is not only because of its realization at any time, in any clinical situation, and its recurrence whenever deemed necessary, but above all for the high diagnostic sensitivity without comparable with other imaging methods. The ultrasound probe used was convex probe (3.5 - 5 MHz). However, smaller frequencies were used when required in order to increase penetration depth in obese patients or when the gall bladder was deeper (eg, in hypersthenic patients). Related to this, in very thin patients (asthenic and hyposthenic) and in pediatric age where the gallbladder is very superficial, a linear probe was used to increase the quality of the image.

A study population of 1250 subjects respectively divided as folloing: 7294 (64.8%) hospitalized patients, 3112 (27.7%) ambulatory and 844 (7. 5%) volunteers underwent US examination in the hospital between January 2010 – March 2013. The ultrasound examination was done in order to assess for possible anatomic variations and their influence in biliary dyskinesia.

Statistical analysis was done as per research protocols where all data were coded and thrown into the computer, from where they were ready for statistical analysis. In the study there were no cases with lack of information regarding one or several variables, therefore the analysis did not contain unknown values (missing values). For categorical variables (nominal and/or ordinal), were reported frequencies (absolute numbers) and the respective percentages. For numeric variables there were reported arithmetic averages ± standard deviations (for the data subject to the normal distribution), and median and interquartile range (when data distribution was not normal). To compare the categorical variables the exact Fisher's test were applied. This statistical test was used e.g. for comparing the shapes and positions of the gallbladder by gender of the subjects involved in the study (men vs. women). In all cases, were considered statistically significant values of $P \leq 0.05$. All statistical analysis was conducted by the Statistical Package for Social Sciences, version 19 0 (SPSS - Statistical Package for Social Sciences Inc., Chicago, IL, USA).

Results

Our study was based on a wide case and enough to make generalizations needed on the main features of the detailed morphology of gallbladder in the Albanian population. Drawing on the main purposes of our study these generalizations are presented in the following conclusions.

We collected the data in the study conducted by the methods described above and the most common anatomic model of gallbladder in general showed us the same as the description already familiar realized by all other authors.

Length	Number	Percentage
<8 cm.	12	3. 74%
8-12cm.	313	95. 33%
>12 cm.	3	0. 93%

Table 1

Determination of the Size of Gallbladder

In 329 cases that underwent ultrasound examination to determine the length and width of the gallbladder, highlighted that in 95.33% of cases ranged from 8 – 12 cm length. The smallest gallbladder 8 cm was found at 3.74% of cases and greater than 12 cm were found in 0.93% of cases (average length 10-13 cm) [Table 1 and Chart 1]

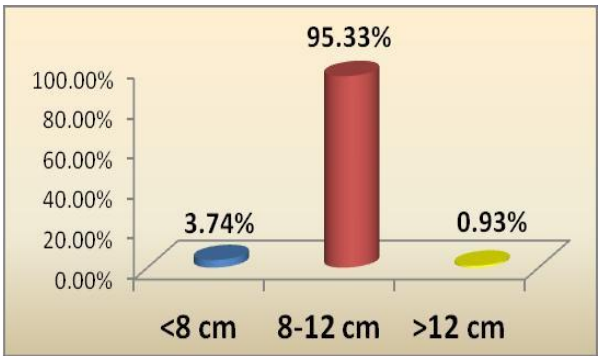

Chart 1

Gallbladder width ranged 2, 5 cm – 3.5 cm in 90.88% of cases. At 3.95% of cases the width of less than 2.5 cm and 5.17% of cases over 3.5 cm (average width 13 cm) [Table 2, Chart 2]

Width	Number	Percentage
<2. 5 cm	13	3.95%
2.5-3.5cm	299	90. 88%
>3.5 cm	17	5.17%

Table 2

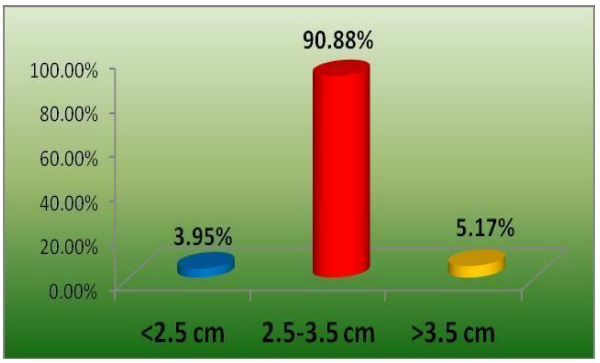

Chart 2

Anatomical Variations and Congenital Abnormalities of Gallbladder

Anatomical variations of hepatic region follow the rules of anomalies in other regions and in generally do not remain solitary. In this context, in the variations of gallbladder can be found associative anomalies of the duct or other parts of the hepatic system.

According to certain objectives variations are studied under sections above and we are summarizing the results.

Anatomical Variations of Gallbladder's Form

The most common form in which it found the gallbladder is pear shaped in which clearly can distinguish the fundus, the body, the neck and the cystic duct [Figure 1 A, B, C, D, E, F].

C form (Fig.1 A)

Baloon form (Fig.1 B)

S form (Fig.1 C)

Cylindric form (Fig. 1 D)

Folded form (Fig. 1 E)

Anchor form (Fig. 1 F)

Table 3. Anatomical variations of the gallbladder shape

Nr.	Anatomical Variations	Males		Females		Males + Females	
		N	%	N	%	N	%
1	Pear shape Gallbladder	5865	99. 42	5229	99. 17	11094	99. 31
2	Lobby Gallbladder	3	0. 05	6	0. 11	9	0. 08
3	C form Gallbladder	6	0. 10	10	0. 19	16	0. 14
4	—Hour Grassll Gallbladder	2	0. 03	3	0. 06	5	0. 04
5	S Gallbladder	18	0. 31	13	0. 25	31	0. 28
6	Ballon shape gallbladder	1	0. 02	6	0. 11	7	0. 06
7	Cylinder shape gallbladder	2	0. 03	1	0. 02	3	0. 03
8	Anchor shape gallbladder	2	0. 03	5	0. 09	7	0. 06
Sub-Total		*5899*	*100.00*	*5273*	*100.00*	*11172*	*100.00*
Indeterminate Form		41	-	37	-	78	
TOTAL						*11250*	*100.00*

Discussion

The gallbladder in the form of pear was found in most of the samples in this study, connected with the findings of many researchers Moore and Dalleu, Chari and Shah 2008. Cylindrical form was surveyed by 1983. Hourglass shaped gallbladder the reported by Shaher 2005. Inverted gallbladder reported by Meilstrup in 1991 after a sonographically - guided study (4, 5, 6).

Two of the most significant variations are folding gallbladder fundusit and neck, which usually is considered anterior folding. Meistrup et al 1991 observed that the return of gallbladder could happen posterioriorly or anteriorly thus leading to common forms and unusual to visualize the ultrasound and other imaging techniques. Futura et al. 2001 observed that there was a significant prevalence present in female subjects than in male subjects. This may be related to the formation of stones in the gallbladder and in the deseases of biliary system in women (1, 2, 3, 4, 5, 6, 7).

The folded fundus of the gallbladder (Phrygian cap) reported in 3 - 7.5% of cases, is considered as a disproportion of the gallbladder between the magnitude and its lodge, but without pathological findings. Deutsch 1986 found this glitch to 0.33% and considered it as a not developped form of congenital septum. Gore et al 2000 found it in 1-6% of the population, and he observed a folded septum between the body and the fundus. The presence of the septum is reported from Csepel et al 2003, Chalkoo 2009 and Talpur et al 2010. Talpur found this glitch in 0.33% of cases. In our study, "Phrygian cap" was similar to the findings of Gore et al and Lichtenstein (1, 2, 3, 4, 5, 6, 7, 8).

On the influence of variations in the complexity of the biliary pathology we can appreciate our findings in light of the references in the literature. In 1988 Bennion found in the literature 208 symptomatic cases of agenesis of gallbladder. 90.1% appeared with dexter hypochondrium pain, 66.3% with nausea or vomiting and 37.5% with intolerance to fats. 32% of these patients showed dilatation of the choledicus duct (9, 10, 11, 12). According to Lindskog, expanding biliary duct without calculus, may suggest sliding of the calculus to the duodenum. However, by comparing the frequency of the choledocal calculus after colecistectomy with that after gallbladder agenesis, he concluded that in the second case the calculus predisposition is greater. In contrast, Ahlberg showed no changes in the composition of bile in patients with gallbladder agenesis, but suggested etiopatogenesy of obstruction of cystic duct or gallbladder contraction. Despite the controversy over the mechanisms of correlation to all authors note referred consistent results. Most patients presented with pain in the right upper quadrant of the abdomen, epigastralgy and backache.

Cases of gallbladder uni/multiseptale reported in the literature were associated with ductal abnormalities, as in the cases registered from us. Such as a major anomalies evident in one of our septal gallbladder is the presence of the pancreaticobiliar duct. Although, our study reconfirmed female predominance as in literature, and the average age was 29.4 years (range from 3 to 70 years) (1, 3, 4, 6, 8, 9, 10, 11, 12).

Conclusions

Ultrasound examination for in diagnosing anatomic variations and congenital anomalies of gallbladder is not only excellent tool of diagnostic modality but a cost-effective examination as well. However in order to offer superior patient care, improvement of operational and diagnostic techniques requires detailed knowledge of anatomical variations and congenital anomalies. For this purpose, there must be a close collaboration between the service of surgery, anatomic laboratory, and imaging services. Total preoperator rating with sophisticated imaging methods is necessary in all cases with clinical context of cholecystitis when the ultrasound suspected congenital anomaly "Phrygian cap". Ultrasound examination should be supplemented with ERCP and MRCP to reach a correct diagnosis with high appearance gallbladder morphological variants and adjacent anatomical structures.

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