

Prevalence of variations of the cystic artery in the Sudanese

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معدّل انتشار الاختلافات في الشريان المراري بين السودانيين
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الخلاصة: إن تشريح الشريان المراري ذو اختلافات كثيرة جداً، مما يخلق مشكلات محتملة أثناء الجراحة. ويوثق الباحثون في هذه الدراسة الاختلافات في منشأ الشريان المراري وموقعه من حيث تعلقه بالقنوات الصفراوية، وذلك لدى 106 من السودانيين، ويقارنون الاختلافات بين الجنسين وبين الأعراق. ينشأ الشريان المراري من الشريان الكبدي الأيمن في 78% من الحالات، ومن الشريان الكبدي الأصلي في 17% من الحالات، ومن الشريان الكبدي الأيسر في 2% من الحالات، ومن الشريان المعدي الاثناعشري في 3% من الحالات، ومن الشرايين الأخرى في 0% من الحالات. ولم يلاحظ الباحثون أي فروق بين الجنسين، كما وجدوا اختلافات يعتد بها إحصائياً في منشأ وموقع الشريان المراري بالمقارنة مع المعطيات المستمدة من دراسات سابقة تناولت القوقازيين والآسيويين.

ABSTRACT The anatomy of the cystic artery is very variable, creating potential problems during surgery. This study documents variations in the origin of the cystic artery and its location in relation to the biliary ducts among 106 Sudanese people and compared the variations between the sexes and races. The cystic artery originated from the right hepatic artery in 78% of cases, the common hepatic artery in 17%, the left hepatic artery in 2% and the gastroduodenal artery in 3% (other arteries 0%). No differences were found between the sexes. Statistically significant variations in the origin and position of the cystic artery were found comparing these data with previous studies in Caucasians and Asians.

Prévalence des variations de l'artère cystique dans la population soudanaise

RÉSUMÉ L'anatomie de l'artère cystique est très variable, ce qui peut entraîner des problèmes lors d'une opération chirurgicale. Cette étude a mis en évidence les variations au niveau de la naissance de l'artère cystique et de sa localisation par rapport aux voies biliaires chez 106 sujets soudanais et a comparé ces variations entre les sexes et les races. L'artère cystique naissait de l'artère hépatique droite dans 78 % des cas, de l'artère hépatique commune dans 17 %, de l'artère hépatique gauche dans 2 % et de l'artère gastroduodénale dans 3 % (autres artères : 0 %). Aucune différence n'a été observée entre les sexes. Des variations statistiquement significatives au niveau de la naissance et de la localisation de l'artère cystique ont été découvertes lors de la comparaison de ces données avec celles provenant d'études antérieures sur des Caucasiens et des Asiatiques.

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Introduction

Anatomical study of the cystic artery is important because its origin from the nearby vessels and because its relation to the biliary ducts is very variable, creating potential difficulties during surgery [1–5]. Usually the cystic artery arises from the right hepatic artery, passing behind the common hepatic and cystic duct in the Calot triangle, to reach the upper surface of the neck of the gall bladder, where it divides into superficial and deep branches [6,7]. Occasionally the cystic artery arises from the hepatic artery and sometimes from the gastroduodenal artery. It passes in front of or behind the bile duct or the common hepatic duct to reach the neck of the gall bladder. The cystic artery might be doubled, and variations in the position and drainage of the artery have been noted [3–5].

The incidence of variations in the origin of the cystic artery has been documented in Caucasians, e.g. in studies by Anson [1] and Daseler et al. [2]. However, the anatomy of the cystic artery in Africans is not well documented.

The aim of this study was to record the variations in origin of the cystic artery from different sources and its location in relation to the biliary ducts among Sudanese people and to compare the variations between the sexes and different races.

Methods

This study was part of a larger anatomical study carried out at the Department of Anatomy at the College of Medicine, University of Khartoum, Khartoum, Sudan, as described previously [8].

The data were collected by dissection of cadavers or exposure during open biliary surgery. In the first group 60 cadavers (45 males and 15 females) were examined in the dissection room in the Department of

Anatomy at the College of Medicine. In the second group 100 patients (30 males and 70 females) undergoing open biliary surgery were examined at 3 hospitals: Khartoum Civil Hospital, Soba University Hospital and Omdurman Civil Hospital. Data for this group were obtained from a master sheet completed by the surgeons.

The anatomy of the cystic artery and the extrabiliary ducts were examined. Variations in the origin and position of the cystic artery from the nearby vessels were noted and the number of cases compared between males and females. Variations in the origin and location between different races were also noted and compared with data from other studies. The chi-squared test was used for comparison of proportions. *P*-value of 0.05 was considered statistically significant.

Results

The origin of the cystic artery was from the right hepatic artery in 125 cases (78%), from the common hepatic artery in 27 (17%), from the left hepatic artery in 3 (2%) and from the gastroduodenal artery in 5 cases (3%). No cases arising from other arteries were noted. There was no statistically significant difference in the origin of the cystic artery between the sexes (Table 1).

When the data about the origin of the cystic artery from Sudanese subjects were compared to those from a study of Caucasians reported in 1947 [2] (Table 2), a statistically significant difference was found, with more cases arising from the common hepatic artery in Sudanese than Caucasians (17% versus 3%), slightly more cases from the right hepatic artery and gastroduodenal artery and slightly fewer from the left hepatic artery.

When the origin of the cystic artery were compared between the Sudanese and

Table 1 Variations in the origin of the cystic artery between the sexes in Sudanese subjects

Origin	Females		Males	
	No.	%	No.	%
Right hepatic artery	66	78	59	8
Common hepatic artery	14	16	13	17
Left hepatic artery	2	2	1	2
Gastroduodenal artery	3	3	2	3

$\chi^2 = 0.988, P > 0.05$.

a study of 50 Asians (Sri Lankans) [3] (Table 2), the results were also significantly different, with more cases arising from the right hepatic artery in Asians than Sudanese (96% versus 78%).

Regarding the position of the cystic artery in Sudanese subjects the following results were obtained: at the Calot triangle in 40 (25%), anterior to the cystic duct in 85 (53%), posterior to it in 21 (13%), anterior to the common hepatic duct in 11 (7%) and anterior to the bile duct in 3 (2%) of cases.

When variations in the position of the cystic artery were compared between Sudanese and Caucasians (Table 3), the results were significantly different. There were far

fewer cases at the Calot triangle in Sudanese (25% versus 70%) and many more cases arising anterior to the cystic duct and right hepatic duct (53% versus only 1%).

Discussion

In this study the origin of the cystic artery and its location in relation to the biliary ducts was documented as part of a wide scale anatomical investigation of the biliary system in Sudanese people [8]. The anatomical study of the cystic artery is important because its origin from the nearby vessels and because its relation to the biliary ducts is variable. The hepatic arteries from which the cystic artery usually arises have also variable origins. They might originate from the main hepatic, gastroduodenal, right or left gastric, the superior mesenteric or rarely from the aorta [9-11].

The origin of the cystic artery in the 160 Sudanese cases investigated was from the right hepatic artery in 78%, from the common hepatic artery in 17%, from the left hepatic artery in 2% and from the gastroduodenal artery in 3%. No cases arising from other arteries were noted. The corresponding proportions in Caucasian subjects

Table 2 Variations in the origin of the cystic artery in Sudanese subjects (present study) and previous data from Caucasians [2] and Asian Sri Lankans [3]

Origin	Africans (Sudanese) (n = 160)		Caucasians (n = 578 ^a)		Asians (Sri Lankans) (n = 50)	
	No.	%	No.	%	No.	%
Right hepatic artery	125	78	416	72	48	96
Left hepatic artery	3	2	36	6	2	4
Common hepatic artery	27	17	16	3	0	0
Gastroduodenal artery	5	3	5	1	0	0
Other	0	0	7	1	0	0
Significance			$\chi^2 = 45.69, P < 0.001$		$\chi^2 = 8.55, P < 0.036$	

^aThe original study was 580 cases; cases in which the cystic artery arises from the superior duodenal artery have been omitted because this abnormality has not been found in Africans or Asians.

Table 3 Variations in the position of the cystic artery in Sudanese subjects (present study) and previous data for Caucasians [2]

Position	Africans (Sudanese) (n = 160)		Caucasians (n = 580)	
	No.	%	No.	%
Calot triangle	40	25	405	70
Anterior to common hepatic duct	11	7	123	21
Anterior to common bile duct	3	2	17	3
Posterior to common hepatic duct	0	0	12	2
Anterior to cystic duct & right hepatic duct	85	53	6	1
Posterior to common bile duct	21	13	3	< 1
Other	0	0	14	2

$\chi^2 = 401.99, P < 0.001.$

investigated by Daseler et al. were 71.7%, 3.0%, 6.3% and 2.5% respectively (with 1% from other arteries) [2]. These proportions were significantly different between Sudanese and Caucasians. They were also different from Sri Lankan Asians, with 96%, 0%, 4% and 0% respectively.

When the results in Sudanese were statistically compared in males and females using the chi-squared test, the results showed no variation in the origin of the cystic artery between the sexes.

There were also variations in the position of the cystic artery in relation to the biliary duct when results from Sudanese and Caucasians were compared. In Sudanese the cystic artery arose at the Calot triangle in 25%, anterior to the cystic duct in 53%, posterior to it in 13%, anterior to the common hepatic duct in 7% and anterior to the bile duct in 2% of cases. Results in Caucasians were 70% at the Calot triangle, 21.3% anterior to common hepatic duct,

2% posterior to common hepatic duct, 3% anterior to bile duct, 0.5% posterior to bile duct, 1% anterior to the cystic duct and 0.2% posterior to the cystic duct [2]. This high rate of variation between the cystic artery and the biliary ducts in Sudanese and other races as well as the presence of accessory cystic arteries might cause problems during cholecystectomy or biliary surgery [12–14].

Conclusions

These results in Sudan cannot be assumed to apply to all Africans. However, in the absence of similar studies of the cystic artery in other African countries, the results demonstrate that there can be substantial variations between Africans and other races in the anatomy of the cystic artery and its location relative to the biliary ducts. There were no variations between the sexes in the Sudanese cases.

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