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Research Paper Anatomy

A Radiological Evaluation of The Length of The Hepatic Artery and its Practical Implications During Liver Transplantation

Dr. Pallavi	(MD Anatomy), Dept. of Anatomy, Father Muller medical college, Mangalore, India. *corresponding author
Dr. Smithi Sripathi	(DNB Radiology), Dept. of radiodiagnosis and imaging, Kasturba medical college, Manipal, India
Dr. Ravichandra V	(MD Pharmacology), Dept. of Pharmacology, K S Hegde medical academy, Mangalore, India.

ABSTRACT

Liver, the largest internal organ in the human body is highly vascular due to the presence of two distinct vascular channels feeding the liver.Common hepatic artery (CHA) is branch of coeliac axis (CA) which continues as proper hepatic artery(PHA) and ends by dividing into right and left hepatic arteries. The point of emergence of the gastroduodenal artery (GDA) determines the relative lengths of the CHA and PHA.Present study was intended to provide a tabular information of the relative lengths of CHA and PHA which can help a surgeon to select/reject a donor liver for transplantation.The study was conducted using 200 images of MDCT angiography done on patients aged between 18 to 80years, for various clinical indications in the department of radiodiagnosis and imaging, Kasturba medical college, Manipal, India.In this study the mean lengths of the CHA and PHA were 3.47cm and 2.08cm respectively. The most frequent range of the CHA length was 3.1-4cm and that of the PHA was 2.6-3m.It was concluded that the knowledge of the relative lengths of CHA and PHA are also an essential part of post-surgical outcome and the surgeon should be aware about the presence of individual variations in the relative lengths of CHA and PHA to select an ideal donor for liver transplantation.

KEYWORDS :

Introduction:

The liver is the largest internal organ in the human body, accounting for approximately 2% to 3% of the total body weight of an adult (1). Rich hepatic vascularity is due to the presence of two distinct vascular channels feeding the liver. Approximately 70% of its total blood flow is derived from the portal vein, constitute functional circulation of the liver and the rest 30% from the hepatic arteries, meeting its nutritional demand (2). CHA arises from the CA and runs towards the liver. Distal to the origin of gastroduodenal artery (GDA), it continues as proper hepatic artery (PHA), which ends by dividing into right hepatic artery (RHA) and left hepatic artery (LHA). Several cases of multiorgan failure are being reported and one of the commonest organs to be involved is the liver.Liver transplantation is the only option for those with irreversible liver failure. Scarcity of cadaveric grafts lead to the emergence of the concept called, Living Related Liver Transplantation (LRLT), which was first performed in 1989 for pediatric liver transplantation. More recently, adult-to-adult liver transplantation has been done using donor's right hepatic lobe. Regenerative capability of liver ensures both the donor and recipient to end up with normal liver function (3).Branches of hepatic artery supplying the liver are essentially end arteries. Therefore, in the context of a liver transplantation even the anomalous arteries should be considered for preservation and revascularization to avoid ischemic parenchymal and biliary tract complications (4). Preoperative assessment of the length of the hepatic artery must be done precisely to ensure optimal donor hepatectomy and graft revascularization.

Substituting Multidetector computed tomography (MDCT) angiography for conventional angiography resulted in a safer, more convenient and better tolerated procedure, as well as in significant cost savings and decreased radiation exposure for the patient and staff (5). MDCTimages of the abdominal aorta and its branches are highly descriptive and the length can be measured easily using post-processing techniques. Highly advanced surgical techniques demand complete knowledge of the arterial morphology as well as its morphometry. Present study is intended to provide a tabular information of the relative lengths of CHA and PHA which can help a surgeon to select/reject a donor liver.

Materials and method:

The study was conducted using 200 images of MDCT angiography done on patients aged between 18 to 80years. It was a prospective study done using the arterial phase images of MDCT done for various clinical indications in the department of radiodiagnosis and imaging, Kasturba medical college, Manipal, India.Images were acquired on Philips brilliance software and were further processed using MPR (multi-planar reformation) technique.Length of the CHA was measured from the point of its origin from the CA till the origin of the GDA. Length of the PHA was measured from the point of origin of the GDA to the point of bifurcation of the PHA into the RHA and LHA. Length of the PHA could not be measured in cases of trifurcation of the CHA or in cases of replaced RHA and/or LHA. Length of the CHA was also not measured in cases where both the RHA and LHA were replaced (Michels' type IV variation) or in cases with early branching of the GDA and PHA directly from the CA. In cases where the CHA or PHA was tortuous, length was measured using curved reformatting tool.

Observations:

The CHA extending from its origin at the CA till the origin of GDA showed different lengths ranging from a minimum length of 1.2cm to a maximum length of 7.2cm. The mean length calculated measured 3.47cm.

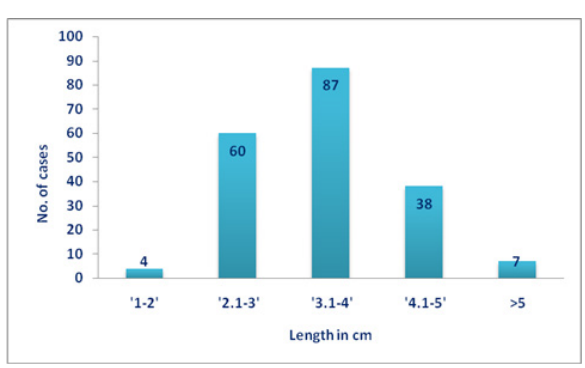

Chart 1: Distribution of cases according to the length of the CHA

Most frequent range of its length was 3.1-4cm, observed in 87 cases. It measured about 2.1-3cm in 60 cases and 4.1-5cm in 38 cases. Less frequent ranges like 1-2cm and >5cm was found in 4 and 7 cases respectively. The CHA was absent in 4 cases due to the replacement of both RHA and LHA. Long CHAs had a tortuous course.

The length of the PHA was measured from the point distal to the origin of GDA to its termination into the RHA and LHA. The measurements were ranging from a minimum length of 0.4cm to a maximum length of 4.2cm. The mean length was calculated to be 2.08cm.

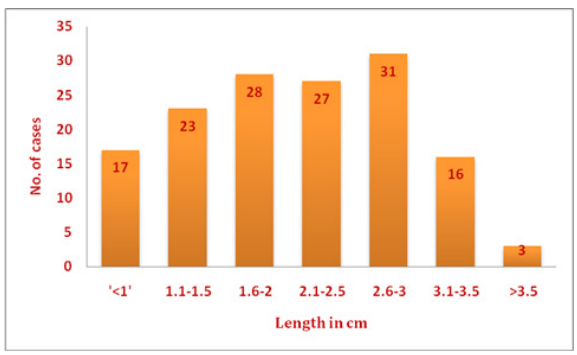

Chart 2: Distribution of cases according to the length of the PHA

Different ranges of its length occurred with almost equal frequencies. Highest frequency of its length was ranging from 2.6-3cm, which was found in 31 cases followed by the range 1.6-2cm in 28 cases and 2.1-2.5cm in 27 cases. The PHA measuring 1.1-1.5cm was found in 23 cases. Very short PHA measuring less than 1cm was observed in 17 cases and longer ones measuring more than 3.5cm was encountered in 3 cases.

In 10 cases length of the CHA and PHA was almost equal but in 15 cases length of the PHA was greater than that of the CHA.

Discussion:

The point of emergence of the GDA determines the relative lengths of the CHA and PHA. The length of these vessels directly reflects the course of the particular artery. A long CHA presents a tortuous course relative to a short artery having a more straight upward inclination.

As per our knowledge and literature search none of the articles has made a mention of the length of the hepatic arteries. But it is wise to have an approximate value of its length which plays an important role in the transplantation technique. One of the major problems in the live donor liver transplantation is thrombosis of the hepatic artery. Tension at the anastamoses will create turbulence of blood flow that can lead to thrombosis. Hence the length of the vessel ends should not be excessively reduced (6). It is important to ensure sufficient length of the graft vessels to prevent kinking, since the graft migrates downwards over time and the arterial patency is vital to graft survival (7).

In the present study the mean lengths of the CHA and PHA were 3.47cm and 2.08cm respectively. The most frequent range of the CHA length was 3.1-4cm and that of the PHA was 2.6-3m. It was interesting to note that the relative lengths of the CHA and PHA were almost equal in young subjects compared to the elderly in whom the CHA was longer than the PHA. Very short PHA measuring less than 1cm observed in 17 cases may be significant for chemotherapy pump placement. This can also disqualify the candidate as a donor, since clamping the artery distal to the GDA becomes difficult and can compromise perfusion to the stomach and duodenum.

Conclusion:

Conducting an uncomplicated and successful liver transplantation requires adequate knowledge of hepatic artery morphology. Knowledge of the relative lengths of CHA and PHA are also an essential part of post-surgical outcome. Present study throws light on the presence of individual variations in the relative lengths of CHA and PHA, of which the surgeon should be aware and can select an ideal donor for liver transplantation.

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