



IMPORTANCE OF ANATOMICAL VARIATIONS FOR SURGERY AND CLINICAL PRACTICE

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ABSTRACT

The human body presents a variety of structural patterns and arrangements, known as anatomical variation. These variations usually have no effect on human health, but some variations may cause surgical faults due to an unusual or variant anatomy that attributed to patient injury. Anatomical variations related to the clinical training is not considered in most of anatomy courses in early medical education. It is crucial for surgeon and physician to know and understand the anatomical variation for effective diagnosis and treatment. It is important to introduce teaching and evaluating the anatomical variations in the medical curricula and postgraduate training of radiological and surgical programs. This review is written to highlight some variant anatomy that can affect the outcome of a surgical procedure and clinical practice.

KEYWORDS: Anatomical Variations, Muscles, Organs, vessels, Nerve.

INTRODUCTION

Variant anatomy is a fundamental part of anatomical science which is related to abnormalities in human body structure. If the anatomical difference from the norm does not alter function, it is not believed a congenital malformation or developmental defect but, instead, called anatomical variation. Variation is the scale of probable change for any distinctive of species. Crucially, variant anatomy is expanding and changing to new diagnostic techniques such as computed tomography, ultrasonography, MRI, moreover the old well-established procedures such as dissection, injection, or corrosion casting.^[1] Most of human variation may be caused by inherited, or developmental factors.^[2] The sources for learning anatomical variations include dissections, published papers, textbook. The surgical anatomy books explain techniques using the standard normal human body and mention the anatomical variations for descriptions.^[3] Variations are mostly essential in clinical practices and surgeries such as an additional branch of artery, a different origin of a muscle may change the achievement of the surgery.^[4] This review article is written to revisit the previously cited examples of anatomical variations that can affect the result of a surgical technique and clinical process.

Anatomical Variations of Muscles

The palmaris longus muscle is supreme donor as grafting material in the plastic and reconstructive surgery.^[5] Palmaris longus muscle is used for tendon grafts in the

replacement of the long flexors of fingers, digital pulley reconstruction, static support for facial paralysis, lip augmentation, and in numerous nerve palsies such as tendon transfer.^[5,6,7] Palmaris longus muscle variations are defined as one of the most frequent muscular variants in the human body and can be associated with presence of the additional heads, bodies, abnormal tendons, and an unusual innervation. Several studies reported the palmaris longus variations like complete agenesis, shape, location and of the fleshy portion, aberration in the attachment in extremity, duplication, triplication, or accessory slips.^[8]

Anatomical Variations of Liver

Understanding the variations of the external morphology of liver is an important clinical aspect during radiological examinations and surgery. The recognition of various morphological variations of liver will aid the radiologists for accurate analysis of the radiological images and the reduction of false reports and help surgeons to reduce injury during surgical processes. The accessory fissures lead to diagnostic mistakes during imaging because these accessory fissures allow collection of the fluid and may be confused for a liver haematoma, cyst, or abscess. Moreover, the tumor cells becoming lodged into these spaces may imitate intrahepatic lesions.^[9] One of the most complications of the accessory liver lobe is torsion mainly in the pedunculated form which necessitates emergency surgical interference. Moreover, they may be mistaken for lymph node or may be

removed during surgery lead to extreme injury and bleeding in the abdomen.^[10]

Anatomical Variations of Cystic Artery

Cystic artery is an essential structure required to be ligated or clipped during cholecystectomy. So, cholecystectomy necessitates precise knowledge of anatomical variations of cystic artery. The cystic artery is a branch of the right hepatic artery, but it may vary to arise from the left hepatic artery, the hepatic artery proper, the common hepatic artery, gastroduodenal artery or even the superior mesenteric artery.^[11,12] Anatomical variation of cystic artery is reported according to its number, relation to biliary ducts, origin, and course.^[11]

Anatomical Variations of Vermiform Appendix

The position of the vermiform appendix may be anatomically variable including retrocecal, pelvic, pre-ileal, post- ileal, paracecal and subcecal. Few studies suggested the anatomical variation of position of vermiform appendix according to age and sex. Anatomical variations of position of appendix may mislead patients' diagnosis with acute appendicitis and may result in severe complications.^[13] The commonest position of vermiform appendix was the retrocecal in adults and the pelvic position in children.^[14] A pelvic appendicitis can extend to the wall of the ureter and bladder, developing urinary symptoms. By contrast, a retrocecal appendicitis can stimulate inflammation of psoas major muscle and produce low back pain, and pain with the extension of the hip.^[15]

Anatomical Variations of Lungs

Anatomical variations knowledge of lungs is crucial during segmental or lobar resections. The lungs are divided by fissures into lobes. The right lung is divided by oblique and horizontal fissures into three lobes while the left lung is divided by oblique fissure into two lobes.^[16] Extra lobes in radiological findings can mislead diagnosis as it may misunderstand as lung lesions. Importantly, pneumonia limited to the affected lobe, but incomplete fissures in patients may spread infection to nearby lobes.^[17,18] Accessory fissures and lobes misinterpreted on X-rays and CT scans and can also be mistaken with clinical illnesses such as pleural scars, linear atelectasis, or walls of bullae.^[17]

Anatomical Variations of Radial Artery

Variations in the position of the blood vessels, course, or the branching pattern can alter routine clinical processes such as intravenous drug application and blood pressure monitoring. Anatomic variations may influence different phases of clinical practice and sometimes require changes in the surgical technique such as amputations, catheterization, or flap surgery.^[19] The upper extremity is a recurrent site of injury. Radial artery is used in the vascular, plastic, and reconstructive surgery and is also used for cannulation and puncture. The origin of the radial artery located in the cubital fossa at the level of the neck of the radius.^[20] The radial artery variations can be

of great clinical significance. The radial artery can exhibit a high origin from the brachial artery or from the axillary artery.^[21] So, knowing transradial access can be hindered or failed by the presence of varying origin and course of the vessel. It has been documented that the presence of a high origin of the radial artery is contributed to the development of tortuosity that led to increase the risk of failure of transradial catheterization.^[22]

Anatomical Variations of Recurrent Laryngeal Nerve

Recurrent laryngeal nerve injury is one of the most prevalent complications of the thyroid surgery.^[23] The vocal cord paralysis and hoarseness of voice are the result of the unilateral recurrent laryngeal nerve injury; however serious complication of the bilateral recurrent laryngeal nerve is reported such as dyspnea and obstruction of larynx. Variant anatomical course of the recurrent laryngeal nerve enables visual misidentification and its injury in thyroid surgery. Anatomical variations of recurrent laryngeal nerve cause struggle for surgeons such as distorted branches, extra laryngeal branches, interweaving between branches of recurrent laryngeal nerve and the inferior thyroid artery, as well as the non-recurrent laryngeal nerve.^[24,25]

Teaching Approaches for Anatomical Variations

Anatomists are encouraged to discover and reexamine all possible teaching methods to improve and develop renovations in the anatomy education.^[26] Importantly, teaching approaches for detecting the anatomical variations include dissection, preoperative imaging, physical examination, and surgical practices are reported.^[12] Anatomy course studies in Vialba Medical School - University of Milan suggested positive effect of the integration of the traditional methods and innovative explanations in learning anatomy but also the importance of critical practice to anatomical variability and radiologic imaging.^[27]

CONCLUSIONS

Anatomical variations knowledge is very important for medical students to have a precise anatomical understanding. Moreover, surgeons can be able to provide accurate diagnoses and prevent complications during surgical techniques. Students feedback should be conducted for studying and assessment of anatomical variations in the medical curricula. Dissections can be beneficial for younger surgeons on human cadavers to improve surgical procedure or build new techniques. Illustrations anatomical variations books and review articles should be collected on scientific database help the accurate analysis of the radiographs such as Computed Tomography and Magnetic Resonance Imaging regions significant for variations in surgery. There are several chances for anatomists, surgeons, and radiologist to collaborate, collect data and perform research for anatomical variations to reduce medical errors in a surgical process and clinical training.

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