The arterial distribution and size of greater omentum

Omentum majus'un arterial yapısı ve boyutları

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ÖZET: *Greater omentum, curvatura ventriculi major ve duodenum'un ilk parçasına tutunup karın boşluğundan aşağıya sarkan ince, yağ ve kan damarlarından zengin bir yapıdır. Son zamanlarda vasküler ve lenfatik yapısı nedeniyle pedinküllü yada serbest olarak hücre proliferasyonu ile doku tamirinin aciz kaldığı, fibroz doku ve yapışıklıkların yoğun gözlendiği olgularda otogreft olarak kullanılır. İskemik kalp, beyin ve ekstremitede kan akımını arttırarak, vesicovaginal fistülün oluşumunu önlemek ve tamir etmek, radikal boyun disseksiyonundan sonra arteria carotis communis'i korumak, lenf ödemi ve hidrosefalide lenfatik drenaj sağlamak gibi değişik amaçlarla kullanılır. Çalışmanın amacı benzer bir durum karşısında, laparotomi öncesi bireylerde omentum boyut ve yüzeyini belirtmek, boy ile bir korelasyon varlığını ve vaskülaritedeki morfolojik özellikleri saptayıp cerrahi yaklaşıma kolaylık sağlamaktır. Bu amaçla postmortem 107 greater omentum örneği incelendi. Arterial dağılımda, arteria gastroomentalis dextra ve sinistra'nın oluşturduğu kavisde 5 farklı tipe rastlandı. Omentum boyut ve yüzeylerinde kadın ve erkek boy uzunluğu ile korelasyon araştırıldı.*

Anahtar kelimeler: **Omentum majus, uzunluk, genişlik, kanlanma**

SUMMARY: *The greater omentum (omentum gastrocolica) is a filmy apron draped over the transvers colon and coils of the small intestine. Clinical importance of the omentum have increased in recent years as it is a unique structure being highly vascular. Intact omentum has been used for a variety of clinical reasons which included attempts to increase blood flow to the ischemic heart, brain and legs; to prevent or repair vesicovaginal fistulas; to protect at operation previously irradiated pelvic organs at operation; to treat lymphedema and hydrocephalus; to repair radionecrosis of the chest wall or flexion creases for reconstruction of the breast and to protect a previously irradiated carotid artery after radical neck dissection. The arterial structure of omentum influences the manner in which the omentum can be lengthened. Also, it is important to know the omental limits before laparotomy. The main aim of this research was to determine the range of lenght and width of omentum and then to correlate them with the height of the the person present. Thus one is able to predict the size and limits of omentum laparatomy. In this study, involving a series of 107 cases, the size of omentum was determined and the types of vascularity were assessed. Correlations between height and omental width, patients' height and omental length were calculated.*

Key words: **Greater omentum, length, width, vascular supply**

THE greater omentum (omentum gastrocolica) is a filmy apron draped over the transvers colon and coils of the small intestine. It is attacted along the greater curvature and the first part of the duodenum. Its left border is continuous with the gastrolienal ligament. Its right border extends to the commencement of the duodenum. If it is lifted and turned back cranialward over the stomach and liver, one sees that it adheres to the transvers colon along the latter's whole length across the abdomen. The greater omentum the largest of the peritoneal folds, is a double sheet, folded on itself to make four layers. This double-layered peritoneal fold normally fuses during the fetal period, thereby obliterating the inferior recess of the omental bursa. As a result, the apronlike greater omentum is composed of four layers of peritoneum.

The membrane forming the greater omentum is thin, transparent and fenestrated, except where there are blood vessels and accumulations of fat. The left and right gastro-omentalis arteries form a wide anastomotic arc between the two layers of its anterior fold. The greater omentum is greatly movable in the living individual and seems to have the ability to spread itself in areas where its presence is useful for the bodily economy. In a cadaver it may be free and spread over the intestines or bunched up near the colon or in a recess. Adhesions, except along the stomach and colon, are abnormal and the result of inflamatory process. It is less absorptive than the peritoneum. It

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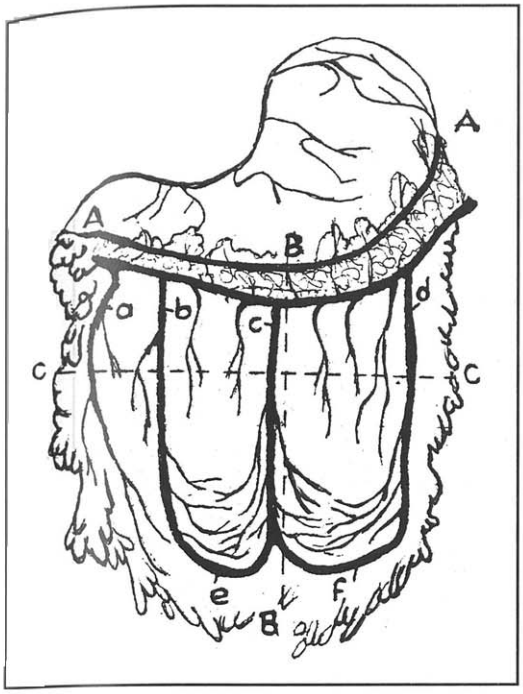

Figure 1. *Sites measured:*
A-A= Stomatch margin, B-B= Lenght in the middle,
C-C= Width in the middle, Arterial supply:
a- accessory omental artery, b- right omental artery,
c- middle omental artery, d- left omental artery
e- left and right arcuate artery.

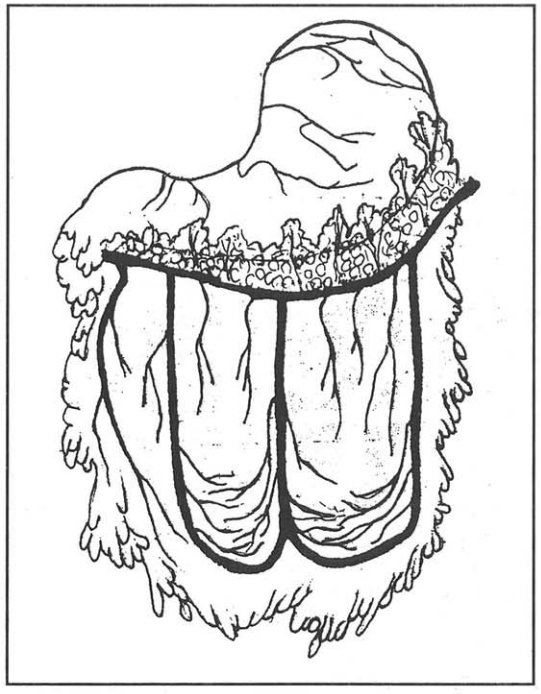

Figure 2. *Type 1 vascular pattern of greater omentum. The middle omental a. bifurcated near the lower end of the omental apron.*

may be congenitally absent and may be removed without apparent ill effect and is hence not physiologically vital. It contains numerous fixed macrophages which are easily mobilized. These may accumulate into dense, oval or round visible "milky spots" as other serous membranes, pericardium and leptomeninges (2, 3, 13, 14, 16).

In previous papers uses of the omentum as an autograft, both pedicle and free, in clinical practices have been described. Because omentum is a mobile structure which has a remarkable power of repair through cellular proliferation, fibrous tissue formation and adhesions. It is rich in lymphatic vessels that rapidly absorb exudate or edema fluid. It is also rich in blood vessels and has enormous power in fighting infections. It will accept a free skin graft and being easily transposed, it is an obvious carrier for remote neovascularization. Intact omentum have been used for a variety of clinical reasons which have included attempts to increase blood flow to the ischemic heart, brain and legs, to prevent or repair vesicovaginal fistulas, to protect at operation previously irradiated pelvic organs, to treat lymphedema of an extremity and hydrocephalus, to repair of radionecrosis of chest wall or flexion creases to reconstruction of the breast and to protect a previosly irradiated carotid artery after radical neck dissection (7-11, 18).

The main aim of the present investigation not only determines the range of length and width of the omentum, but also correlates them with the height of the person so that one is able to predict the size, within limits, before laparatomy. This study attempts therefore to analyze the different morphologic features of the vascularity of greater omentum.

MATERIAL and METHODS

107 greater omentum were obtained from cadavers released by the Forensic Medicine Council Izmir Group Chairmanship between 1994 - 1995. Autopsy cases which did not have any previous abdominal surgery varied in age from 19 to 82 years. They were all from caucasians of whom 22 were females and the remainder male. All the postmortem were carried out within 36th hour of death. The abdominal cavity was entered through an upper median incision. The greater omentum was brought out of the cavity and spread on the wet saline gauze for close inspection the anterior and posterior layers of the omentum on vascular distribution.

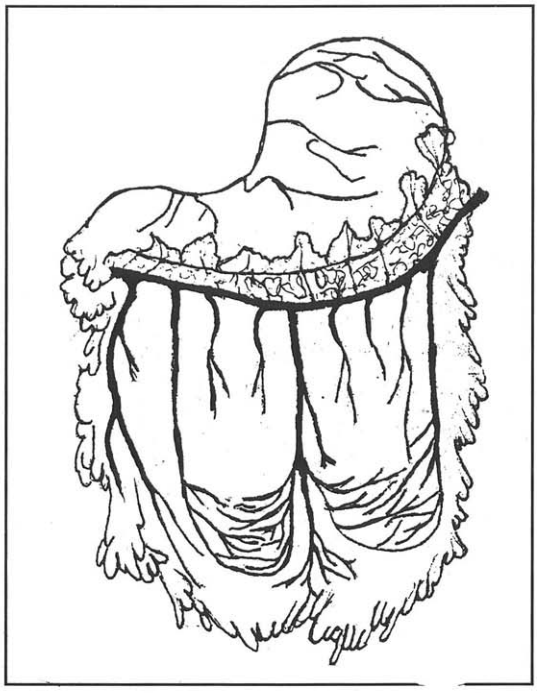

Figure 3. *In type 2 vascular pattern, the middle omental a. bifurcated midway between gastroomental arch and end of omental apron.*

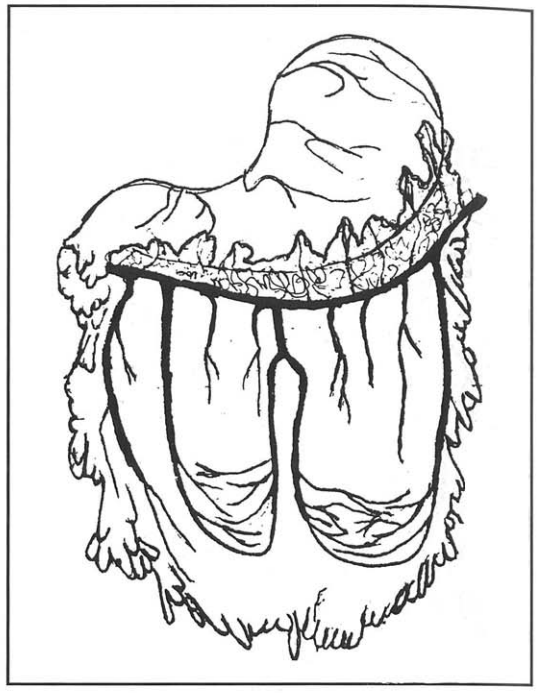

Figure 4. *Type 3 vascular pattern the middle omental artery divided 2 to 3 cm from the gastroomental arch.*

The omentum was considered sickle-shaped, the concave border being attached to the greater curvature and the convex border being free. The upper curved line was stomach margin (A - A), the length was measured from the mid-point of A - A line extension a perpendicular line to the free margin of the greater omentum which is usually in the middle of the free border (B - B). The width was taken as the distance the free lateral borders at the transversely 6 cm below the centre of the greater omentum (C - C). The height of the individuals were recorded and plotted against the omental measurements (Fig. 1). Surface area of omentum was calculated on graph papers.

The range and averages of length and width in males and females are shown in the Table I. Correlations between height and omental width, patients' height and omental length were calculated. These correlation curves show a degree of predictability for the size of the omentum in any one patient. The comparisons of the measurements between autopsy groups were tested for statistical significange using Regression Output.

RESULT

The blood supply to the greater omentum was derived from the right and left gastro-omental arteries which join along the greater curvature of the stomach to form the arch of the gastro-omental arteries. These major arteries comprise the right omental arteries which was a branch of the right gastro-omental arteries; the The middle omental arteries which arised at the junction of the right and left gastro-omentales arteries, the left omental arteries which was a branch of left gastro-omental artery. The accessory omental artery which arised from the gastro-omental arch immediately proximal to the take off the right omental arteries; and short omental arteries which arised from the gastro-omental arch between the major omental vessel. The middle omental arteries bifurcates into a right and left branch following its take off from the midpoint of the gastro-omental arch. These branches joined the right and left omental arteries, thus forming a right and left arterial arcade. It was encountered five anatomical patterns of vascular arcade of the omentum, depending upon the level of bifurcation or the absence of the middle omental artery. Each was managed differently.

Type 1. The middle omental arteries divided near the lower end of the omental apron. This was the most common vascular pattern encountered within the omentum, having been present in 79 or 73.83 percent of the 107 autopsy (Fig. 2).

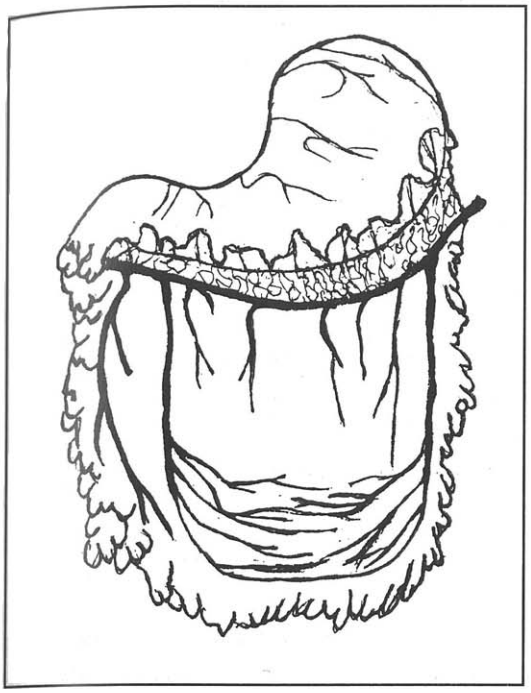

Figure 5. *In type 4 vascular pattern, the right and left omental arteries joined omental vascular arch without the presence of the middle omental artery.*

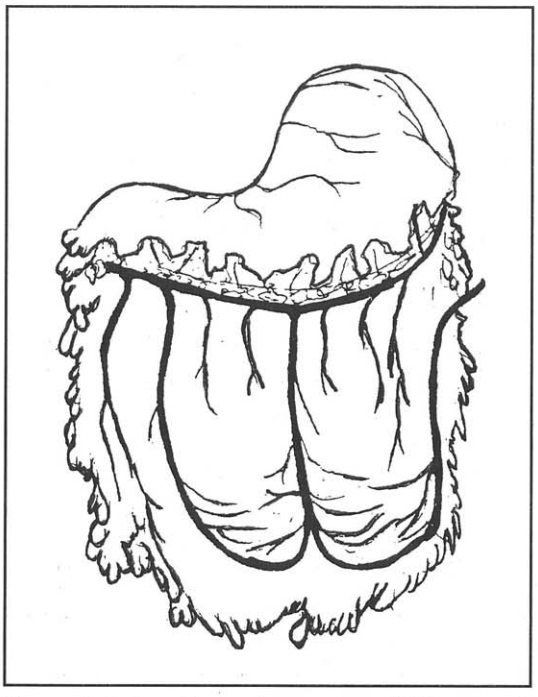

Figure 6. *In type 5 vascular pattern middle omental artery arised from the left gastroomental artery.*

Type 2. The middle omental arteries bifurcated or trifurcated midway between the gastro-omental arch and the lower end of the omental apron. This anatomic presentation was found in 15 or 14.01 percent (Fig. 3).

Type 3. The middle omental arteries bifurcated or trifurcated about 2 to 3 centimeters from the gastro-omental arch. This was found in 8 autopsy or 7.48 percent (Fig. 4).

Type 4. The right omental arteries and sinistra joined to form an omental vascular arch without the presence of the middle omental artery. This configuration was seen in 4 autopsy or 3.74 percent (Fig. 5).

Type 5. The terminal branch of the splenica artery did not participate in the formation of the gastroepiploic arch but instead developed into the left omental arteries. The right gastro-omental artery diminished in calibre as it transversed the lower portion of the greater curvature and never developed communication with the rami gastrici. The middle omental arteries arose from the right gastro-omental arteries. At autopsy, this anatomic setting was found 1 or 0.93 percent (Fig. 6).

The height of the individuals were recorded and plotted against the omental measurements. The range and averages of length in males and females are shown in the Table 1,2,3,4,5. Correlations between autopsies' height and omental width, autopsies' height and omental length were calculated (Fig. 7-9).

DISCUSSION

In this study we found different features of vascularity and the size of omentum. The measurements in the living and the dead is statistically similar (1). Imaginative clinical uses of intact omentum have been increased in frequency. The arterial structure of omentum influences the

Table 1. *Measurement of omentum is males and females (±Sd)*

	Males	Females	Total
n	85	22	107
Average height, cm	174.41±5.87	160.95±6.32	171.80±8.13
Omentum measurement of A-A (cm)	31.3±6.02	29±4.917	30.84±5.89
Omentum measurement of B-B (cm)	25.07±5.99	20.13±6.26	24.05±6.37
Omentum measurement of C-C (cm)	29.03±8.48	28.36±6.54	28.89±8.12
Area of omentum (cm^2)	746.03±321.88	596.68±290.48	715.32±321.4

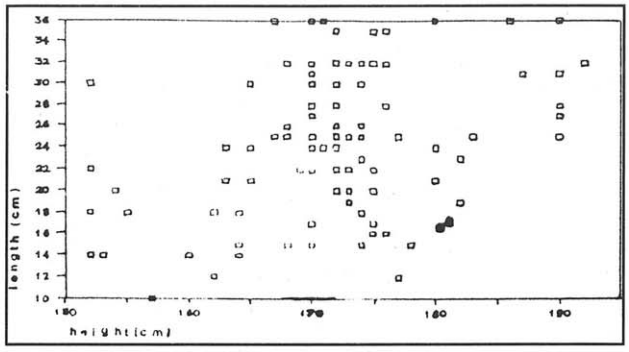

Figure 7. *Correlation comparing length of the omentum in the middle with height of the individual in total.*

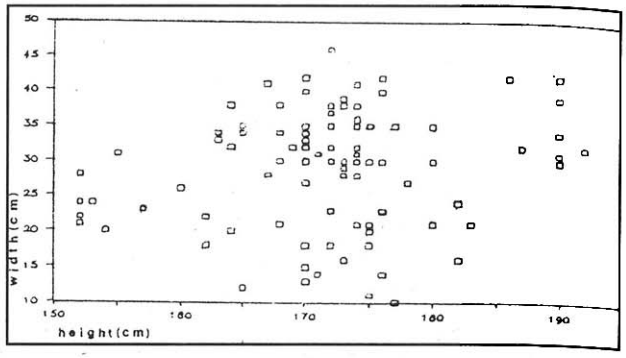

Figure 8. *Correlation comparing height of the individual with the width of omentum in total.*

manner in which the omentum can be lengthened. It is necessary to apply knowledge of the developmental anatomy and of the blood supply (1, 17, 18). The blood vessels of the omentum come to a large extent from two different sources; the main source is the vascular arch on the curuvatura ventriculi major, formed by the left and right gastro-omental artery; from this arch multiple arteries course distally, supplying the anterior layers of the greater omentum. The right gastro-omental artery is a branch of the gastroduodenal artery but, on occasion, originates from the superior mesenteric artery. The left gastro-omentalis artery originates immediately prior to the terminal branching of the splenic artery. Two of the larger branches, the left and right omental artery, pass in the lower third of the omentum, from the anterior into posterior layer of the omentum and establish a second arch, the arcus epiploicus magnus of Barkow (1, 6, 15, 17).

Table 2. *Regression analysis of omentum measurements (A-A) on height*

	Males	Females	Total
n	85	22	107
r squared	0.436	0.728	0.539
constant	-3.358 0.198H	-37.839 0.415H	-5.614 0.212H
Standart error of estimate	5.982	4.361	5.685
Standart error of regression coefficient	0.110	0.147	0.068

Table 3. *Regression analysis of omentum measurements (B-B) on height*

	Males	Females	Total
n	85	22	107
r squared	0.170	0.386	0.365
constant	-5.435+0.174H	41.6+0.383H	-25.181+0.286H
Standart error of estimate	5.981	6.063	5.990
Standart error of regression coefficient	0.110	0.204	0.071

Table 4. *Regression analysis of omentum measurements (C-C) on height*

	Males	Females	Total
n	85	22	107
r squared	0.386	0.643	0.179
constant	1.817+0.176H	-79.011+0.667H	-1.833+0.178H
Standart error of estimate	8.520	5.253	8.071
Standart error of regression coefficient	0.157	0.177	0.095

These findings may help in the assessment of the minimum and maximum length and width of the omentum, before laparotomy, when one is comtemplating the use of the omentum outside the abdomen or its pedicle. Das initially measured the length and width of the omentum in 200 cadavers and 100 laparotomies. He found omental length (B-B) 14 - 36 (25) cm in males and 14 - 34 (24) cm in females. The omental width (C - C) was 23 - 46 (35) cm in males, 20 - 46 (33) cm in females. It was demonstrated that there was a close correlation between measurements of omentum

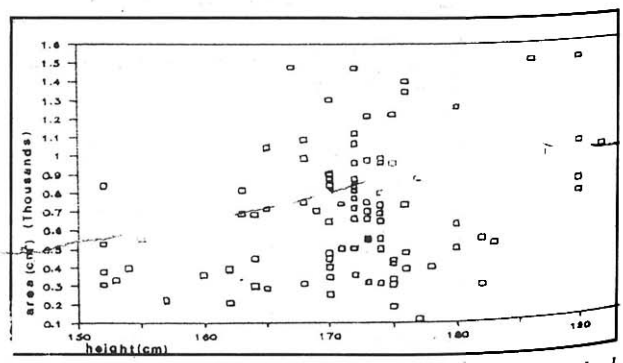

Figure 9. *Correlation comparing height of the individual with the area of omentum in total*

Table 5. *Regression analysis of omentum area on height*

	Males	Females	Total
n	85	22	107
r squared	0.212	0.364	0.332
constant	-1291.77+11.67H	-3636.45+26.30H	-1543.74+13.149H
Standart error of estimate	318.250	249.841	305.962
Standart error of regression coefficient	5.871	8.427	3.637

and body (4). In another research belong to Das, omental length in the middle (B - B) was 25.35 ±4.22 cm (14.5 - 36) L= 16.33 + 0.127Wt in males and 24.4 ±3.9cm (14.4 - 34.4) L= 12.3 + 0.181 Wt in females. Measurement of C - C width was found 34 (22 - 46.5)cm, W=17.1 + 0.093 H in males and 32.5 (19 -45) cm, W=25.35 + 0.343 H in females (5). We conclude that correlation between width and length of omentum and length of people show a degree of predictability for the size of the omentum. As the result of this study, the morphological features of vascularity is necessary to apply mobilization of the omentum. Same results were observed in previous reports. This study will obtain cumulative knowledge of the greater omentum for surgeons.

Alday et al examined 136 adult autopsy, in order to know various vascular patterns of omentum. They encountered type 1 in 116 (85.2%), type 2 in 14 (10.2%), type 3 in 4 (2.9%), type 4 in 1 (0.7%), type 5 in 1 (0.7%) autopsy (1). Wu et al described same five vascular pattern of the greater omentum. They reported type 1 in 26 (37.1%), type 2 in 16 (22.9%), type 3 in 12 (17.1%), type 4 in 7 (10 %), type 5 in 9 (12.9 %) patients in according to anatomical patterns that arteria omentalis media had adequate communicating vessels with the artery (17). Both researches informed that lengthening can be used also for the determining of middle and left omental arteries (1, 17).

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