



## Variations in Course of Inferior Epigastric Artery- Importance in Laproscopic Surgery

Jay Kishor Soren<sup>1</sup>, M.S.Gond<sup>2</sup>, Dhananjay Sharma<sup>3</sup>, Vivek Srivastav<sup>4</sup>

<sup>1</sup>Junior Resident Academic, Dept Of Surgery, NSCB Medical College ,Jabalpur

<sup>2</sup>Associate Professor, Dept Of Surgery, NSCB Medical College, Jabalpur

<sup>3</sup>Professor, Dept. Of Surgery NSCB Medical College, Jabalpur

<sup>4</sup>Assistant Professor, Dept Of FMT, NSCB Medical College, Jabalpur

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### ABSTRACT

**Background:** Laparoscopy has been in vogue for various surgical procedures for more than two decades. . Using the conventional established points for making portals, though safe, at times can lead to injury of blood vessels of anterior abdominal wall, as course of blood vessels supplying anterior abdominal wall is not mapped preoperatively, mainly the inferior epigastric artery(IEA). Trauma to abdominal wall vessels is 0.2%-2% of laparoscopic procedures. Injury to IEA is one of the commonest

#### Objectives

1. To observe the course of inferior epigastric artery in fresh cadaver.
2. To determine safe zone for laparoscopic port placement.

**Materials And Methods:** 30 fresh cadavers were dissected by midline insertion and bilateral IEA were exposed. We measure the distance of IEA at different level from midline. We measure bilateral IEA at the pubic symphysis at 3.5 cm and 7 cm and 10 cm and umbilicus from pubic symphysis in midline and at the level of umbilicus. We observed variation in length, course of IEA in cadavers.

**Results And Conclusion:** We observed variation in length, course of IEA in cadavers. We also found that there is a safe zone in anterior abdominal wall. We found there is more lateral shift of IEA in left side.

**Keywords:** inferior epigastric artery, trocar injury, abdominal wall

### I. INTRODUCTION

Laparoscopy has been in vogue for various surgical procedures for more than two decades. Gastroenterologists, gynaecologists and general surgeons are extensively using abdominal laparoscopy for various surgeries like tubectomy, appendicectomy, cholecystectomy, to name a few. Patric Steptoe, one of the pioneers in laparoscopy used this approach for aspiration of preovulatory oocytes in in vitro fertilization. Making necessary portals in the anterior abdominal wall for introducing laparoscope and its accessory instruments are done with trocar and cannula after inflating the peritoneal cavity with CO<sub>2</sub>. Piercing sharp trocar is a blind procedure. Using the conventional established points for making portals, though safe, at times can lead to injury of blood vessels of anterior abdominal wall, as course of blood vessels supplying anterior abdominal wall is not mapped preoperatively, mainly the inferior epigastric artery (IEA). Trauma to abdominal wall vessels is 0.2%-2% of laparoscopic procedures. Injury to IEA is one of the commonest complications encountered and the incidence is about 3 per 1000 cases. Mapping IEA, hence is an important guideline to avoid vessel injury. IEAs, conventionally, are understood to be located in the area between 4 and 8 cm from midline and hence staying away from this dangerous strip defines safety zone for the anterior abdominal wall. However, variations in the course of IEA can cause haemorrhage as a result of injury to the vessel. Variations in the origin, course of IEA and abnormal communication of IEA, and obturator artery can be studied by cadaveric dissection, computed tomography (CT) and ultrasonography. Present study was conducted to understand the course of IEA on right and left side in 50 fresh cadavers in post mortem.

### **Inferior Epigastric Artery**

Inferior epigastric artery (IEA) refers to the artery that arises from the external iliac artery and anastomoses with the superior epigastric artery. Along its course, it is accompanied by inferior epigastric vein. It arises from the external iliac, immediately above the inguinal ligament.

It curves forward in the subperitoneal tissue and then ascends obliquely along the medial margin of the deep inguinal ring: continuing its course upwards, it pierces the transversalis fascia, and passing in front of the linea semilunaris (arcuate line), ascends between the rectus abdominis and the posterior lamella of its sheath.

It finally divides into numerous branches, which anastomose, above the umbilicus, with the branches of superior epigastric branch of the internal mammary (internal thoracic artery) and with the lower intercostals arteries.

As the IEA passes obliquely upward from its origin, it lies along the lower and medial margins of the deep inguinal ring and behind the commencement of the spermatic cord. The vas deferens, in the male, as it leaves the spermatic cord, and the round ligament of the uterus in the female, winds around the lateral and posterior aspects of the artery. Present study was primarily aimed to find out the course of IEA, variations in its terminations and its distance from midline.

## **II. AIMS AND OBJECTIVES**

1. To observe the course of inferior epigastric artery in fresh cadaver.
2. To determine safe zone for laparoscopic port placement.

## **III. MATERIALS AND METHODS**

Type of study:- Prospective study

Place of study:- Department of general surgery ,NSCB medical college Jabalpur

Duration of study:- October 2014 to October 2015

Inclusion criteria:- Fresh cadaver

Exclusion criteria:- Formalin preserved cadaver.

No. of cases:-30 fresh Cadavers

In fresh cadavers, IEA will be exposed by opening the rectus sheath. Rectus will be divided and IEA will be exposed. Five reference points A,B,C,D and E will be define as A will be at pubic symphysis, while E at umbilicus. B,C and D will be marked at the distance of 3.5, 7 and 10.5 cm, respectively from pubic symphysis. Distance of the IEA from these midline points will be measured with the help of metal scale.

## **IV. OBSERVATION AND RESULTS**

In our study, we see that there is wide variation of inferior epigastric artery in its course and insertion of inferior epigastric artery. We measured its distance from pubic symphysis as point A. Point B,C, and D were defined as 3.5 cm successively from point A and Point E is umbilicus. There is no uniform distance of IEA in every cadaver from midline. It varies with built and age of cadaver.

The nearest point of entry of IEA was 2.2 cm on right side and 2 cm on left side from pubic symphysis. The farthest point from pubic symphysis was 6.5 cm on right side and 8 cm on left side.

The minimum distance of IEA from point A on right side was 2.2 cm and left side was 2 cm. The maximum distance of IEA from point A on right side was 6.5 cm and left side was 8 cm.

The minimum distance of IEA from point B on right side was 2.2 cm and left side was 2.1 cm. The maximum distance of IEA from point B on right side was 7 cm and left side was 7 cm.

The minimum distance of IEA from point C on right side was 3.2 cm and left side was 3 cm. The maximum distance of IEA from point C on right side was 8 cm and left side was 8 cm

The minimum distance of IEA from point D on right side was 4 cm and left side was 3.2 cm. The maximum distance of IEA from point D on right side was 9 cm and left side was 9.4 cm

The minimum distance of IEA from point E on right side was 4 cm and left side was 4.2 cm. The maximum distance of IEA from point E on right side was 10.5 cm and left side was 10.9 cm.

In our study, it is found that there is lateral shift of arterial strip of It IEA at point D and E, as compared to Manvikar Purushottam et al<sup>[1]</sup> study.

In our study shifting of arterial strip at level C,D,E was found on rt side as compared to Manvikar Purushottam et al<sup>[1]</sup> study.

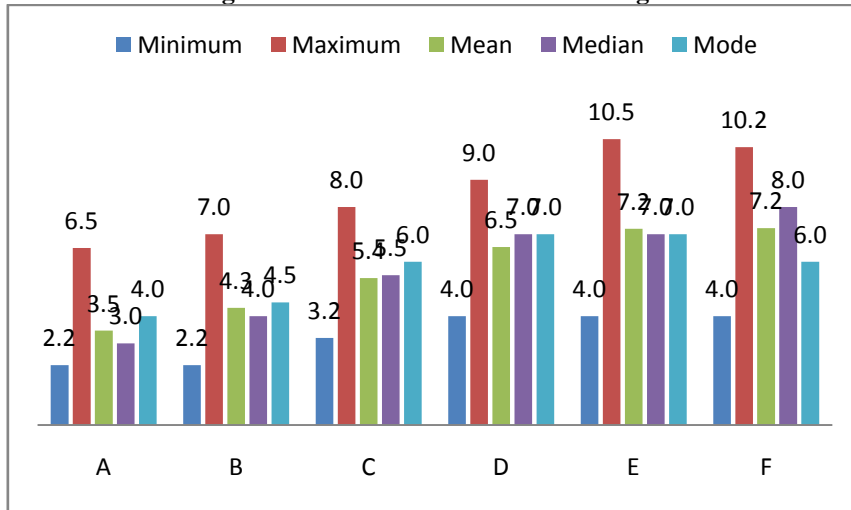
In our study, safe zone/area ,Nearest point of entry of rt IEA at the level of pubic symphysis is 2.2 cm, at point B 2.2 cm, at point C 3.2 cm, at point D 4 cm, at point E 4 cm. Nearest point of entry of lt IEA at the level of pubic symphysis is 2 cm, at point B 2.1 cm, at point C 3 cm, at point D 3.2 cm, at point E 4.2 cm.

Area is beside midline bilaterally with different distance at different level according to the course of IEA.

**Table no. - 1**  
**Measurement (In Cm) At Various Levels On Right Side**

R i g h t	A	B	C	D	E
Range[min-max] (in cm)	2 . 2 - 6 . 5	2 . 2 - 7 . 0	3 . 2 - 8 . 0	4 . 0 - 9 . 0	4 . 0 - 10 . 5
M e a n	3 . 5	4 . 3	5 . 4	6 . 5	7 . 2
M e d i a n	3 . 0	4 . 0	5 . 5	7 . 0	7 . 0
M o d e	4 . 0	4 . 5	6 . 0	7 . 0	7 . 0
±Std. Deviation	0 . 9	1 . 2	1 . 1	1 . 3	1 . 5

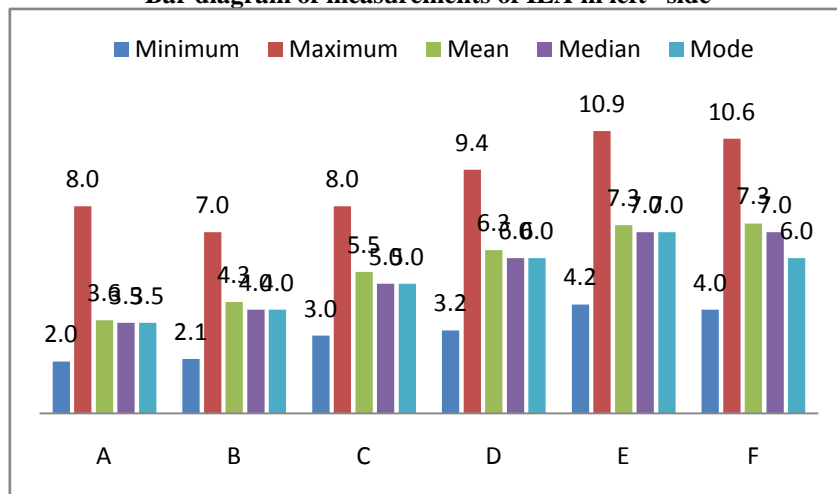
**Graph no. - 1**  
**Bar Diagram Of Measurements Of Iea In Right Side**



**Table no. - 2**  
**Measurement (in cm) at various levels on left side**

L e f t	A	B	C	D	E
Range [min-max](in cm)	2 . 0 - 8 . 0	2 . 1 - 7 . 0	3 . 0 - 8 . 0	3 . 2 - 9 . 4	4.2-10.9
M e a n	3 . 6	4 . 3	5 . 5	6 . 3	7 . 3
M e d i a n	3 . 5	4 . 0	5 . 0	6 . 0	7 . 0
M o d e	3 . 5	4 . 0	5 . 0	6 . 0	7 . 0
±Std. Deviation	1 . 1	1 . 2	1 . 0	1 . 4	1 . 6

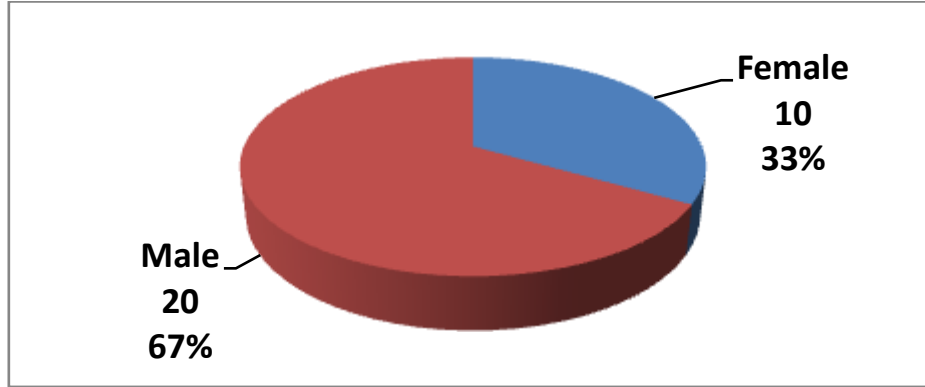
**Graph no. - 2**  
**Bar diagram of measurements of IEA in left side**



**Table no. - 3**  
**Male female ratio**

Sex	No of patients	Percent
Female	10	33.3
Male	20	66.7
Total	30	100.0

**Sex Distribution**



## V. DISCUSSION

Most of the earlier studies done for mapping vessels of anterior abdominal wall was indirect and direct methods like CT scan, colour Doppler and transillumination.

In Indirect methods, mapping was done by dissection on formalin preserved cadavers. In our study, 30 fresh cadavers were dissected in which 10 were female.

### Distance of IEA from midline

There is great variation in course of inferior epigastric artery. Minimum distance from point c was 3.2 cm and maximum was 9.0 cm in rt side. In left side it was 3.0 and 9.4 cms.

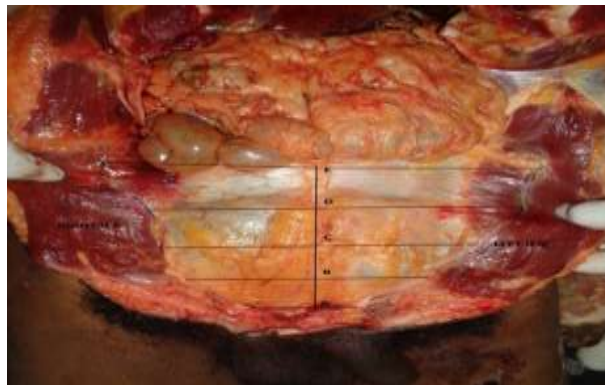
We found that in our study strip of It IEA is shifted more lateral in comparison with study of Manvikar Purushottam et al<sup>[1]</sup>.

In our study, mean distance of right IEA from A,B,C,D,E were 3.5 cm, 4.3 cm, 5.4 cm, 6.5 cm and 7.2 cm respectively as compared to Manvikar Purushottam et al<sup>[1]</sup> study , in which these values were 5.37 cm, 4.5 cm, 4.06 cm, 3.47 cm, 3.40 cm respectively.

Mean distance of left IEA from A,B,C,D,E were 3.6 cm, 4.3 cm, 5.5 cm, 6.3 cm and 7.3 cm respectively as compared to manvikar purushottam et al<sup>[1]</sup> study , in which these values were 5.3 cm, 4.63 cm, 4.04 cm, 3.52 cm, 3.10 cm respectively.

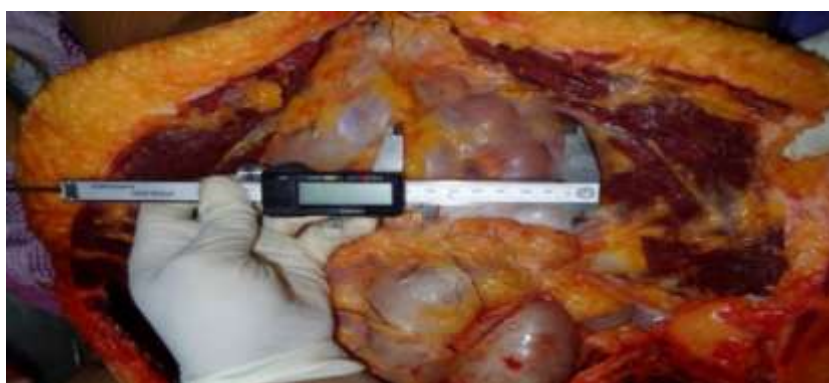
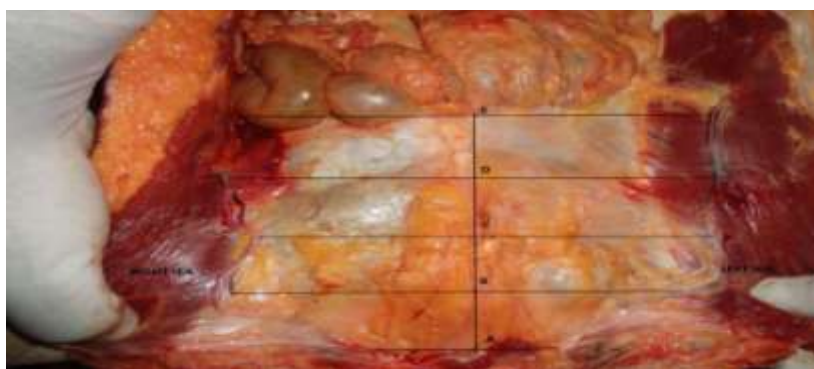
### Safe zone/area

There is safe zone, in anterior abdominal wall, where less chance of injury to inferior epigastric artery. We found that in our study, area of safety insertion of port, should be different at different level of anterior abdominal wall. Our study is comparable with Manvikar Purushottam et al<sup>1</sup> study.



Umbilicus

Study show that if we will away from vessels and more towards midline than there will be safe placement of trocar in anterior abdominal wall and there is least chances of haemorrhage due to injury to IEA.



## VI. SUMMARY

30 fresh cadavers were dissected by midline insertion and bilateral IEA were exposed. We measure the distance of IEA at different level from midline. We measure bilateral IEA at the pubic symphysis at 3.5 cm and 7 cm and 10 cm and umbilicus from pubic symphysis in midline and at the level of umbilicus. We observed variation in length, course of IEA in cadavers. We also found that there is a safe zone in anterior abdominal wall. We also compare our study with previous study of Manvikar Purushottam et al<sup>1</sup> study. Our study is comparable with above study which was done on formalin preserved cadavers. We found there is more lateral shift of IEA in left side.

## VII. CONCLUSION

Minimal access surgery is today's demand due to many advantages over conventional open surgery. Anterior abdominal wall is important structure for accessing abdominal organs. Placement of trocar and cannula is blind process, hence there is chances of injury to IEA. This study showed that there is lot of variation in course of IEA on both side, preoperative mapping or assessment of course of IEA is helpful in decreasing in incidence of injury to it.

We concluded that trocar placement near to midline is always safe to prevent IEA injury.

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