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Salvatore Giovanni Vitale*, Nicola Gasbarro**, Antonio Simone Laganà*, Fabrizio Sapia***, Agnese Maria Chiara Rapisarda***, Gaetano Valenti***, Maria Antonietta Trovato***, Diego Rossetti°, Benito Chiofalo*, Giuseppina Barrasso*** Andrea Tinelli°, Francesco Corrado*

*Unit of Gynecology and Obstetrics, Department of Human Pathology in Adulthood and Childhood “G. Barresi”, University of Messina, Messina, Italy.

**Independent Researcher, Pozzuoli (Napoli), Italy

***Department of Medical Surgical Specialties, Gynecology and Obstetrics Unit, University of Catania, Italy

°Department of Maternal and Child Health, Gavardo Hospital, Brescia, Italy

°°Department of Gynecology and Obstetrics, Division of Experimental Endoscopic Surgery, Imaging, Minimally Invasive Therapy and Technology, Vito Fazzi Hospital, Lecce, Italy

Safe introduction of ancillary trocars in gynecological surgery: the “yellow island” anatomical landmark

AIM: This technical note aims to suggest a safe introduction of ancillary trocars in gynaecological surgery, in order to prevent inferior epigastric artery damage.

MATERIAL OF STUDY: We performed a narrative overview, synthesizing the findings of literature retrieved from searches of computerized databases.

RESULTS: Among the different techniques, the identification of the “yellow island” as anatomical landmark seems to be a useful aid to avoid complication. This particular landmark is identified taking the lateral third of a line between the anterior superior iliac spine and the umbilicus as reference points, by a subperitoneal accumulation of adipose tissue located in that area.

DISCUSSION: “Yellow island” could be considered a safe place for trocars introduction because epigastric artery never runs there, even in patients with particular anatomical variants. This technique is particularly useful in obese patients, in which “yellow island” appears to be more evident respect to lean ones. Furthermore, the use of “open” trocars insertion may reduce the possibility of epigastric artery lesions respect to “Verres needle technique”.

CONCLUSION: The identification of the “yellow island” anatomical landmark could be considered an useful aid for the safe introduction of ancillary trocars in gynaecological surgery.

KEY WORDS: Gynaecology, Laparoscopic surgery, Trocars placement

Introduction

Advanced laparoscopic procedures as an alternative for laparotomy have been progressively increasing in gynaecological surgery during these last decades. Current evidence suggests clear benefits of laparoscopy respect to the “classic” laparotomic gynaecological surgery, reducing post-surgical pain, surgical site infections (decreased relative risk 80%), hospital stay (2 days less), postoperative adhesions (decreased by 60%) and quicker return to activity (2 weeks sooner) ¹. The widespread use of laparoscopy has led the development of more advanced minimally invasive procedures that require placement of several trocars through the abdominal wall ¹⁻³. Initial access into the abdomen is one of the major challenges of laparoscopy, because it can cause injury to the gas-

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Correspondence to: Salvatore Giovanni Vitale, M.D., Unit of Gynecology and Obstetrics, Department of Human Pathology in Adulthood and Childhood “G. Barresi”, University of Messina, Via Consolare Valeria 1, 98125 - Messina, Italy (e-mail: vitalesalvatore@hotmail.com)

trointestinal tract, urinary tract and blood vessels. Trocar insertion injury occurs in <1% of cases, with 50% of these complications that occur during the first access to the abdominal cavity⁴. A shared consensus concerning the optimal laparoscopy entry technique does not exist, therefore surgeons applied a wide spectrum of instruments and developed different entry techniques. Among these, none has been identified as being safe enough to prevent complications associated with laparoscopic entry^{5,6}. Because of the rarity of trocar insertion injury (1%), there are no prospective randomized studies to prove the safest method⁴.

To date, Verres needle-pneumoperitoneum-closed trocar entry is the most common laparoscopic entry technique⁵. Laparoscopic access systems have two main components: an outer sleeve or port and a removable inner trocar used to facilitate insertion. The port remains in place in order to allow insufflations and allow the passage of instruments. About trocar insertion, laparoscopic access system can be classified into two categories: blunt dilating-tip-trocars and cutting bladed-tip-trocars. The first one consists of a sharp plastic or metal blade that cuts through tissue layers as force is applied, while the second groups separates and dilates tissues as force is applied⁷⁻¹⁰. In any case, both the technique are not out of risk: according the recent data^{11,12} the most common structures injured during the first trocar insertion are vessels of the abdominal wall and the bowel, especially in case of adhesions for previous abdominal surgery. The estimated risk of vascular injury is reported to be 0.9/1000 and the rate of bowel injury 1.8/1000¹³. In particular, one of the most dangerous complications during trocar insertion is the injury to the inferior epigastric artery (IEA), a collateral branch of the external iliac artery¹⁴. In this view, it is extremely important to have confidence with the anatomy of abdomen circulation, in order to prevent and manage surgical complications.

Considering this scenario we performed a narrative overview, synthesizing the findings of literature retrieved from searches of computerized databases, in order to suggest a safe approach for the introduction of ancillary trocars in gynaecological surgery.

The “yellow island” anatomical landmark

When the IEA originates beneath the inguinal ligament, it runs medial to the inguinal ring. Usually, it arises from the external iliac artery, 6.2 cm above the inguinal ligament¹⁵. Nevertheless, the IEA can arise from the femoral artery below the inguinal ligament, from the profunda femoral artery and even as a common trunk with the circumflex iliac artery¹⁶. In addition, the obturator artery can arise from the IEA and may run either lateral or medial to the femoral ring to reach the obturator foramen in 20% of patients¹⁵. Sometimes, the

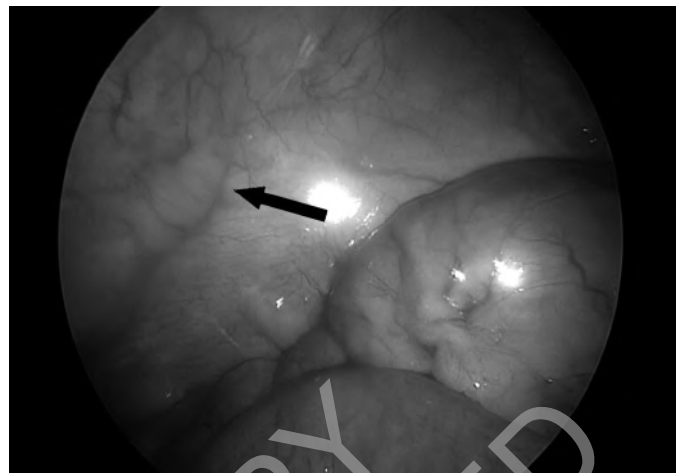


Fig. 1: Laparoscopic view of the “yellow island” (arrow).

superficial epigastric artery can appear on the medial portion of dorsal surface of the rectus muscle¹⁷. In general, the superficial epigastric artery arises from the front of the femoral artery about 1 cm below the inguinal ligament, runs through the femoral sheath and the fascia cribrosa, turns upward till the anterior part of the inguinal ligament and finally ends between the 2 layers of the superficial fascia of the abdominal wall¹⁸. Basing on these elements, it is mandatory to avoid epigastric artery damages during the first trocar introduction, identifying the safest site for gain access to the abdominal cavity. Thus, there is a particular landmark defined “yellow island” (YI), which may be helpful to avoid IEA injury. YI is identified, taking the lateral third of a line between the anterior superior iliac spine and the umbilicus as reference points, by a subperitoneal accumulation of adipose tissue located in that area¹⁸ (Fig. 1).

Discussion and Conclusion

As was already showed¹⁹, epigastric artery never runs that zone. This appears more useful in obese patients (in which laparoscopy results more difficult), due to a larger yellow island respect to lean patients. In order to clearly show the YI, we suggest to use “open” entry technique instead of the “Verres needle technique”: as widely reviewed elsewhere^{1-3,20}, the first step consist of an incision made lengthways just underneath the umbilicus to avoid scarring. Afterwards the incision should involve transversalis fascia, rectus muscles and peritoneum. It is possible also to cut transversally after using a Farabeuf retractor, in order to open around 1.5 cm through blunt dissection, pull aside the rectus muscles and expose the peritoneum. In addition, Hasson trocar could be used during open technique²¹.

For lateral trocars insertion, transillumination can be used in order to prevent epigastric artery damage, although

the efficacy is not complete especially in obese women²². During trocar insertion, force should be controlled to avoid abdominal wall lesions. Trocar insertion should be perpendicular to abdominal wall, and when trocar tip is in contact with peritoneum, it should be pushed towards the isthmus of the uterine tube in order to avoid pelvic vessels. If IEA injury occurs, it is not advisable to pull out trocar because it determines partially hemostasis closing upstream and downstream blood flow; conversely, we suggest to insert a paediatric Foley catheter inside the trocar, inflate the balloon and then remove the trocar. When haemostasis is complete, sutures can be undertaken.

In conclusion, we take the opportunity to underline the importance to prevent IEA injury and suggest to individuate YI, because it allows easier and safer trocar insertion during laparoscopic surgery, especially in obese patients in which epigastric artery is difficult to localize with transillumination technique.

Riassunto

SCOPO: Questa nota tecnica ha lo scopo di individuare un metodo di introduzione sicura dei trocari ancillari in chirurgia ginecologica, al fine di prevenire lesioni dell'arteria epigastrica inferiore.

MATERIALE DELLO STUDIO: È stata eseguita una revisione narrativa, sintetizzando i dati della letteratura ottenuta dalla ricerca di database computerizzati.

RISULTATI: Tra le varie tecniche, l'identificazione dell' "isola gialla" come repere anatomico sembra essere di valido ausilio per evitare complicanze. Questo particolare repere è identificato da una zona di accumulo di tessuto adiposo subperitoneale sul terzo laterale di una linea che congiunge la spina iliaca anteriore superiore e l'ombelico.

DISCUSSIONE: L' "isola gialla" può essere considerata come una zona sicura per l'inserimento dei trocari, dal momento che l'arteria epigastrica non decorre in quell'area, neanche in pazienti con particolari varianti anatomiche. Questa tecnica è particolarmente utile nelle pazienti obese, in cui l' "isola gialla" è maggiormente evidente rispetto alle pazienti magre. Inoltre l'utilizzo della tecnica "open" di inserzione dei trocari potrebbe ridurre il rischio di lesioni dell'arteria epigastrica inferiore rispetto alla tecnica di induzione del pneumoperitoneo con ago di Verres.

CONCLUSIONE: L'identificazione dell' "isola gialla" può essere considerata un valido ausilio per l'introduzione sicura dei trocari ancillari in chirurgia ginecologica.

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Commento e Commentary

PROF. NICOLA PICARDI
già Ordinario di Chirurgia Generale

Per operare con sicurezza, evitando danni involontari a strutture importanti è indispensabile una conoscenza accurata dell'anatomia dell'area di intervento. La anatomia chirurgica classica aveva definito i metodi per localizzare sulla superficie cutanea la proiezione in sede più profonda dei vasi e dei nervi a decorso sottostante. Lo scopo di queste nozioni era quello di facilitare la ricerca cruenta di queste strutture con minimo danno ai tessuti. Era l'epoca precedente allo sviluppo della tecnologia ecografica, e gli studi di anatomia chirurgica facilitavano la ricerca dei vasi anche in caso di assenza o iposfigmia dei polsi, con le esercitazioni di medicina operatoria sul cadavere, oggi malauguratamente trascurati. Il decorso dell'arteria epigastrica inferiore con tutte le sue possibili varianti è compresa in un'area triangolare con base all'arcata inguinale, vertice all'ombelico, e lato esterno segnato da una linea decorrente dal punto di mezzo dell'arcata inguinale e lo stesso ombelico. La linea proiettiva della stessa arteria epigastrica inferiore, in base agli studi di anatomia chirurgica è teoricamente fissata per sicurezza dal punto medio dell'arcata inguinale all'ombelico, e questa nozione è essenziale per evitare danni in corso di paracentesi. Per procedere in sicurezza il trocar deve rimanere all'esterno di questa linea proiettiva, nello spazio laterale compreso tra questa e la linea tracciata tra spina iliaca anterior superiore e ombelico. Lo studio di questi Autori è finalizzato ad accrescere la sicurezza nella fase iniziale di un intervento laparoscopico diretto al basso addome o in area pelvica, e conferma con la visione dall'interno della cavità addominale le nozioni di anatomia chirurgica, che possono essere meglio dimostrate e confermate per transilluminazione in pazienti non obesi.

* * *

The better anatomical knowledge of the surgical areas where to operate is the indispensable basis for the success of any surgery especially to secure against unintentional damage. The classic surgical anatomy had defined the methods to locate on the skin surface projection in the deepest seat of superficial vessels and nerves course. The purpose of these notions was to facilitate the eventually needed bloody search of these structures with minimal damage to the tissues. It was then the time preceding the development of ultrasound technology, and surgical anatomy studies also facilitated the search of vessels in case of pulsless conditions, with exercises of operative medicine on corpses, unfortunately neglected today.

The inferior epigastric artery course with all its possible variants is enclosed in a triangular area that has the base at the inguinal arch, vertex at navel, and the outer side in the line between the middle point of the inguinal arch and the same navel. For safety the projective line of the same epigastric artery was defined in surgical anatomy as commencing from the midpoint of the inguinal arch ligament toward the navel, and this notion was essential to avoid damage e.g. during paracentesis. To proceed safely the trocar had to remain outside of the projective line, laterally in the space between it and the line connecting the anterior superior iliac spine to the navel.

The present study aimed at increasing security in the initial phase of a laparoscopic surgery in the lower abdomen and pelvic area, confirms these notions in the vision from inside the abdominal cavity, which could also be even better confirmed and demonstrated by transillumination in non obese patients.

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