

## Dynamic self-regulating prosthesis in inguinal hernia repair

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**SUMMARY:** Dynamic self-regulating prosthesis in inguinal hernia repair.

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*Inguinal hernia repair is one of the most common surgical procedure performed in Western countries and it consumes a lot of healthcare resources. Several types of different mesh are now disposable and tension-free techniques represent the "golden standard". In our study, fifty male patients were operated on for inguinal hernia and a PAD (i.e., dynamic self-regulating prosthesis) used for the repair of the inguinal defect: this technique demonstrated to be safe, effective and easy to perform.*

**RIASSUNTO:** Le protesi autoregolantesi dinamica nella riparazione delle ernie inguinali.

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*L'ernioplastica inguinale rappresenta uno degli interventi chirurgici più frequentemente eseguiti nel mondo occidentale, con un importante utilizzo di risorse anche economiche. Sono oggi disponibili numerose tipologie di materiali protesici e le tecniche di riparazione tension-free rappresentano quelle più utilizzate. Nel nostro studio abbiamo analizzato i risultati ottenuti nella plastica inguinale protesica con protesi autoregolantesi dinamica (PAD), cui sono stati sottoposti 50 pazienti di sesso maschile affetti da ernia inguinale. La procedura si è dimostrata di semplice esecuzione, sicura ed efficace.*

**KEY WORDS:** Ernioplastica inguinale - PAD-mesh.  
Inguinal hernia repair - PAD-mesh.

## Background

Inguinal hernia recurrence is treated by surgery and hernia itself, even if only slightly symptomatic, is an indication for surgical intervention. There have been significant changes in hernia surgery recently (1). The failures of traditional tissue approximation repair (2) have been attributed by surgeons not only to errors in technique but also to a substantial basic error (3) that violates a fundamental principle of surgical technique: the approximation, by suture, of structures that are ana-

tomically different, far away from each other and reconstructed under tension. Recent studies have highlighted the inherent primary physiological "fragility" of the musculoaponeurotic structures of the posterior wall of the inguinal canal, responsible for both their progressive weakening and the occurrence of the hernia. This pathological condition may also be secondary to a metabolic disorder involving involution of collagen fibers and elastic fibrous connective tissue (4).

Peacock (5) and Read (6) found morphological and biochemical evidence of this defect in the transversalis fascia, with altered collagen fibril periodicity, reduced hydroxyproline and abnormal lipid infiltration. They also reported an unacceptable failure rate with hernia repair by tissue approximation (7). These considerations have led to the development of new methods for the surgical repair of inguinal hernias, based on the principle of a total "dynamic barrier" (8). These techniques involve the use of a complex dynamic self-regulating prosthesis (i.e. "protesi autoregolantesi dinamica" or PAD) as proposed by Valenti

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et al. (9). It consists of two layers of polypropylene mesh of a standard shape and size. These are placed between the aponeurosis of the external oblique muscle and the posterior wall of the inguinal canal in two parallel planes, and are sutured on one side only. The lower, approximately trapezoidal layer has a pre-cut notch for the passage of the spermatic cord. Its lateral edge is placed parallel to the inguinal ligament and left unsutured, while the two tails are anchored to the fascia of the rectus abdominis muscle. The upper layer is slightly larger and is the same shape as the posterior wall of the inguinal canal, which it covers completely. Its lateral edge, which has a small opening for the passage of the spermatic cord, is sutured to the inguinal ligament with polypropylene stitches along the length of the prosthesis, while the medial edge lies free on the sheath of the rectus muscle just below the aponeurosis of the external oblique muscle. The top edge of the prosthesis lies over the internal inguinal ring and the bottom edge overlaps the pubic tubercle by 1-2 cm. The two layers slide past each other independently, enabling the prosthesis to adapt dynamically to changes in the inguinal anthropometrics, the anatomy of the inguinal canal and the physiological changes in the various structures of the musculoaponeurotic structures. In this way, the prosthesis fits all inguinal shapes and volumes without creating any tension or traction during muscle activity, ultimately preserving the area's flexibility and dynamism. This adaptability means that the PAD provides a total dynamic barrier (10) against the pressure exerted by the abdominal contents on the back wall of the inguinal canal. This effect extends well above Haselbach's triangle and is a key factor for its efficacy, as the degenerative process causing the hernia extends well beyond the anatomical boundaries of this triangle and may cause a new hernia to form many years after the first operation. In addition, the lower layer of the prosthesis creates a neo-inguinal ring that protects the original deep orifice from any new herniation, due both to its structural strength and to the restoration of the natural defense mechanism against straining muscles.

Unlike prosthetic hernioplasties involving the placement of a wall plug (11), the PAD (9) does not require the use of a plug (3, 7) thus avoiding the vascular and organ damage that can occur, albeit rarely (0.5-1% of cases) (12), from its migration.

## Patients and methods

From September 2009 to September 2010, 50 men aged between 24 and 67 years (mean age 44.6) with inguinal hernia underwent hernia repair (PAD and flat plug hernia repair) at the De-

partment of General Surgery, University of Catania (14). Work duties were reported as light by 60% of the patients and heavy by 40%. All patients had previously undergone routine preoperative investigations and were admitted on the day of surgery, which was performed under local anesthesia (lidocaine 1%) after informed consent had been obtained.

The hernia was found to be indirect in 38 cases (76%) and direct in 12 (24%). Nine (18%) were classified as small, 32 (64%) as medium and nine (18%) as large.

The procedure was carried out as follows: a 5-6 cm incision was made. When the external oblique fascia was reached, the inguinal nerves were blocked with the injection of more local anesthetic. The external oblique muscle fascia was then incised and the front wall of the inguinal canal opened. The cremasteric muscle was spread and the hernia sac identified and pushed back into the internal ring. The cremaster was sutured (optional) and plication of the transversalis carried out. The smaller mesh was placed around the spermatic cord parallel to the inguinal ligament and sutured to the medial muscular plane. The larger mesh was attached to the pubis, taking care not to include the periosteum with the Prolene suture. A second stitch was sewn between the prosthesis and the inguinal ligament, 1 cm apart, and a third stitch applied in front of the hole surrounding the spermatic cord. Finally, the external oblique fascia was sutured, leaving the cord below it.

Patients were able to walk a few hours after surgery and were discharged the next day. Follow-up (minimum 6 months, maximum 1 year) consisted of close monitoring for complications for the first 15 days and scheduled check-ups every 30 days and then every two months to rule out any complications due to the prosthesis and check the repair.

## Results

The procedure was fast, easy and well tolerated by patients, given the reduced postoperative discomfort. Walking was encouraged 2-3 hours after surgery. Postoperative administration of analgesics in the wound site was required in just 18% of patients, and only for the first 24-48 hours after the surgery. The short hospitalization and discharge 24 hours after the operation is a great advantage to both patients, enabling their faster return to everyday activities, and the hospital, reducing costs associated with a longer stay. To date there have been no recurrences or other significant complications.

## Conclusions

Inguinal hernioplasty using PAD is now well standardized and technically easy. There is no need to shape or cut the prosthesis due to its intrinsic ability to adapt dynamically to different shapes and sizes of inguinal canal. Postoperative complications and early and delayed recurrence are limited, suggesting that this is a valid alternative for the prosthetic repair of inguinal hernias.

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