

Effective operative training in hernia repair for junior surgery residents

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Leistenbruch-OP: Effektive Ausbildung und Training

Zusammenfassung. *Grundlagen:* Das Erlernen operativ-technischer Fähigkeiten ist ein wichtiger Bestandteil der chirurgischen Ausbildung und kann nur durch persönliche Erfahrung und Training erreicht werden. Wachsender Kostendruck und die Einführung von Arbeitszeitbegrenzungen führt zunehmend zu kritischen Diskussionen über die, für die chirurgische Ausbildung benötigte, zusätzliche Operationszeit. Daher ist es notwendig neue Strategien zu entwickeln um Operationszeiten zu verkürzen ohne die chirurgische Ausbildung zu gefährden. Das Ziel dieser Studie war es zu untersuchen, ob sich durch die Verwendung eines selbsthaftenden Netzes beim offenen Leistenhernienverschluss, welcher durch unerfahrene Assistenzärzte durchgeführt wurde, die benötigte Operationszeit gegenüber Eingriffen unter Verwendung eines klassisch fixierten Netzes reduzieren lässt.

Methodik: Es wurden 65 Patienten, bei denen ein offener Hernienverschluss mit Netzeinlage durch unerfahrene Assistenzärzte (Erfahrung <10 offene Herniotomien) unter Anleitung eines erfahrenen Chirurgen durchgeführt wurde, in die Studie eingeschlossen. Wir führten einen Vergleich der Operationszeiten und Kosten unter Verwendung eines klassisch durch Naht fixierten Netzes (Ultrapro™, Ethicon, Norderstedt, Germany) und eines selbsthaftenden Netzes (Parietex ProGrip™ Mesh, Covidien, Co. Dublin, Ireland) durch.

Ergebnisse: Unter Verwendung des selbsthaftenden Netzes beim offenen Hernienverschluss in der chirurgischen Ausbildung konnten die benötigten Operationszeiten sowie die Kosten bei gleichbleibenden Resultaten signifikant reduziert werden.

Schlussfolgerung: Die Modifikation eines einzelnen Operationsschrittes durch die Verwendung eines neuen

Implantats in der offenen Hernienchirurgie kann die Operationszeit sowie die durch die chirurgische Ausbildung entstehenden Kosten signifikant reduzieren.

Schlüsselwörter: Leistenhernienverschluss, chirurgische Ausbildung, Operationstraining, ProGrip, Op nach Lichtenstein.

Summary. *Background:* Operative skills are essential components of surgical education and can be acquired only through personal experience and training. Increasing financial constraints and working-time limitations bring the needed extra-time for surgical training into sharp focus. New strategies to reduce operative time without deteriorating the surgical education are needed. The aim of this study was to analyze if the use of a self-gripping mesh in open hernia repair performed by junior surgery residents can reduce operative time compared to the use of classically fixed meshes.

Methods: Sixty-five patients with open hernia repair performed by junior surgical residents (experience <10 open hernia repairs) guided by a senior surgeon were enrolled to this study. Comparing the use of a classically fixed mesh (Ultrapro™, Ethicon, Norderstedt, Germany) with a new self-gripping mesh (Parietex ProGrip™ Mesh, Covidien, Co. Dublin, Ireland) we analyzed the needed operative time.

Result: Using the new self-gripping mesh in surgical training, the operative time and costs needed for open inguinal hernia repair decreased significantly without influencing the results.

Conclusion: Changing one step of a specific operation using a new device in open hernia repair can reduce the operation time and costs significantly.

Keywords: Inguinal hernia repair, surgical education, operative training, ProGrip, open hernia repair.

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Introduction

Training general surgery residents is a challenging and difficult task. Operative skills are essential components of

surgical education and can be acquired only through personal experience and training. Although several groups have shown that resident involvement does not affect patients' safety [1–4] surgical training increases operative time and costs [3, 5]. Not only modern hospital management but also the limitation of working time given by the "European working time directive" for the European countries brings the needed extra-time for surgical training into sharp focus [6]. Although several authors discuss the positive effect of simulation-based training in laparoscopic surgery [7, 8], there are hardly any strategies known to reduce the operative time in the training of open surgical procedures. However, it is still common practice in most teaching hospitals that operative skills are trained performing common surgical procedures such as open inguinal hernia repair. Doing the operation guided by a senior surgeon, the resident gains the experience to ensure safe and optimal outcomes. Owing to the increasing external pressure, strategies are needed to reduce operative times without deteriorating the surgical education.

Chastan reported about the safe use of a novel low density, macroporous mesh with semi-resorbable self-fixing properties. In this study very short operation times were reported for Lichtenstein mesh repair as the self-gripping mesh can be placed very easy and fast [9].

The aim of this study was to analyze if the use of a self-gripping mesh in open hernia repair performed by junior surgery residents can reduce operative time compared to the use of classically fixed meshes.

Material and methods

In the time period between January 2006 and January 2008, 65 male patients (mean age 62 ± 13 years) were enrolled in this study. All patients were treated using clinical pathways to standardize surgical procedures in our center. Operative time was defined as the time from skin incision to the placement of the final dressing. All operations were performed by a junior general surgery resident (experience <10 open inguinal hernia repairs, $n = 22$) directed by a senior general surgeon ($n = 10$). In the first group (G1) a semi-absorbable lightweight (28 g/m^2) mesh (Ultrapro™, Ethicon, Norderstedt, Germany) was used. In the second group (G2) the inguinal hernia repair was performed using a bicomponent (polyester and polylactic acid) lightweight (38 g/m^2) self-gripping mesh that incorporates resorbable polylactic acid micro hooks (Parietex ProGrip™ Mesh, Covidien, Co. Dublin, Ireland). All patients operated by junior residents suffered from primary small hernias (LP1/2 and MP1/2 according to the European Hernia Society [10]). To compare senior surgeons' operative times, all repairs of recurrent hernia and big hernias (LP3, MP3, LR1-3, MR1-3) were excluded from this group.

Technique

After skin incision and division of the external oblique aponeurosis the space necessary for the mesh was created

along the inguinal ligament from the pubic tubercle toward the anterior superior iliac spine and between the external oblique aponeurosis and the conjoint tendon to exhibit the rectus muscle aponeurosis. The cord was identified; the cremaster muscle resected, and the 3 nerves were preserved. The hernia sac was isolated and resected, the peritoneum closed with absorbable suture material. Using the ProGrip™-Mesh (G2) the self-gripping flap was released and loosely closed around the cord. The fixation after carefully orientating to the final position was achieved by applying pressure on the mesh starting on the pubic tubercle, going up medially onto the internal oblique aponeurosis. The cranial part was brought under the external oblique aponeurosis; then the mesh was pressed gently toward the inguinal ligament. Generally no additional fixation was necessary.

Using the Ultrapro™-device (G1) the mesh was trimmed to the needed size and cut to leave space for the cord. It was then brought to the final position. The fixation was achieved by a continuous absorbable suture toward the inguinal ligament and single stitches medially onto the internal oblique structures.

The external oblique aponeurosis and skin in both groups were closed with absorbable sutures.

Data collection

Patients' demographic and disease as well as procedure related data were collected in a clinical information system (ISHmed on SAP platform, GSD, Berlin, Germany) prospectively. Differences between groups were calculated using the SPSS® (Version 14, Chicago, Illinois, USA) software, and SAS Analytics (SAS Institute GmbH, D-69043 Heidelberg, Germany). Data are given as absolute numbers, mean and standard error of the mean or as median (range) unless indicated otherwise.

Short-term results were documented 10–14 days after the operation doing clinical examination. The median long-time follow-up was 12 months. The long-time results were confirmed by clinical examination. The visual analog scale was used to document the patients' pain.

Results

Between January 2006 and January 2008 390 inguinal hernia repairs were performed in our center (235 open, 155 laparoscopic). Sixty-five Lichtenstein mesh repairs were performed by lower level junior general surgery residents ($n = 22$, experience <10 open inguinal hernia repairs) directed by a senior general surgeon ($n = 10$). The mean age of patients operated was 62 ± 13 years.

Operation times

Using classically fixed meshes (G1, Ultrapro™) the mean operative time for open inguinal hernia repair was 67.48 ± 23.5 min. The mean operative time of inguinal hernia repair performed by inexperienced surgeons decreased significantly to 46.8 ± 18.8 min using the self-

Tab. 1: Patients' characteristics

Parameters	Ultrapro (G1)	ProGrip (G2)	<i>p</i>
<i>N</i>	31	34	
Age [years]	63.1 ± 13.3	62.9 ± 15.9	n.s.
BMI*	25.7 ± 5.3	26.1 ± 6.3	n.s.
ASA-Score**	2.0 ± 0.6	2.1 ± 0.4	n.s.
COPD***	3	4	n.s.
CAD****	20	24	n.s.
Renal failure	1	3	n.s.

*BMI body mass index, **ASA American Society of Anaesthesiologists, ***COPD chronic obstructive pulmonary disease, ****CAD coronary artery disease.

Tab. 2: Operative time

Parameter	Ultrapro (G1)	ProGrip (G2)	<i>p</i>
<i>Operative time [min]</i>			
Junior Residents	67.5 ± 23.5	46.8 ± 18.8	<0.001
Senior Surgeons	40.7 ± 16.3	35.9 ± 12.9	<0.001

gripping mesh (Table 2). Describing the patients' age, the physical status according to the ASA-classification, and the patients' body mass index (BMI) no significant distinction between the two cohorts was ascertained (Table 1).

Compared to the mean operative times needed by senior surgeons, surgical training needed in G1 26.8 min, and in G2 10.9 min extra time. Interestingly the use of the self-gripping mesh only decreased the mean operative time of senior surgeons by 4.8 min (40.7 min vs. 35.9 min).

Results

Analyzing the short-term results the two groups were comparable. In the long-term follow-up in both groups one patient had to be recorded with a recurrent inguinal

Tab. 3: Results (all operations performed by junior surgeons)

Parameters	Ultrapro (G1)	ProGrip (G2)	<i>p</i>
<i>Short-term results</i>			
Cord induration	1	0	n.s.
Hematoma	1	1	n.s.
Seroma	0	1	n.s.
Wound-infection	0	0	n.s.
<i>Long-term results</i>			
Mesh-infection	0	0	n.s.
Recurrence	1	1	n.s.
Pain	2	1	n.s.
Induration	0	0	n.s.

hernia (Table 3). Three patients reported about pain 12 months after the operation.

Discussion

Developing technical skills is essential to surgical resident training. While residents with limited experience require more intensive supervision than those at advanced levels, they must be provided with adequate opportunities to learn techniques and skills [11]. Modern hospital management has placed increasing financial constraints on hospitals and physicians that may further compromise the availability of operating room time for teaching purpose. The cost of using operating room time for training surgical residents in the US is an estimated US\$ 53 million per year [12]. Additionally, not only financial constraints but also working-time limitations are a reality that every training program has to deal with. Many authors have expressed concern about the potential for decrease in case numbers as a result of working time limitation [13, 14]. Therefore new strategies to reduce operative time without deteriorating the surgical education are needed.

In this study we showed that changing one step of a specific operation using a new device, like the self-gripping mesh in open hernia repair, can reduce the operative time significantly. Changing only the used mesh still gives the resident the opportunity to practice standard operations, to understand the anatomical structures, and to develop surgical skills. This fact keeps the quality of education high. Together with this positive effect on surgical training a cost saving aspect of the used mesh has to be reported. As discussed by Babineau and colleagues it is difficult to compare the exact costs of operation minutes due to hospital-specific differences [3]. However, some studies estimate operation time to cost between US\$ 5 and US\$ 25 per min [3, 12, 15]. In the reported cases this means a cost saving of between US\$ 100 and US\$ 500. Analyzing the estimated costs per operation minute in our center we saved up to US\$ 500 per teaching operation using the ProGrip™ Mesh (estimated costs per operation minute US\$ 25). In contrast to strategies that are developed for laparoscopic surgery using simulated tasks [16] the use of the new device did not produce any extra costs. This study was not designed to compare the two meshes in a randomized setting but the follow-up findings of our study underline that surgical education is save for the patient and can be performed with good long-term results. Critically it has to be mentioned that suturing the mesh might be one of the most challenging parts of the operation for inexperienced surgeons. Even though this step cannot be trained using the self-gripping mesh it still gives the young surgeon the possibility to understand the anatomical structures and to develop surgical skills. This study focuses on junior residents with a very low experience level. The time-saving effect of the self-gripping mesh is much smaller when it is used by senior surgeons. Nevertheless in many hospitals junior residents are trained for performing common surgical procedures such as open inguinal hernia repair. Our findings might describe a small aspect but we state that with smart

changes, excellent organization and standardization – surgical education still is possible and satisfying for both residents and senior surgeons. Nevertheless, discussing time- and cost-saving aspects of surgical training, it is important to keep in mind that excellent education results in a benefit for the society in the long term.

Conflict of interest

The authors declare that there is no conflict of interest.

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