SUTURELESS FUNCTIONALLY ADAPTIVE FIXATION METHOD FOR INGUINAL HERNIOPLASTY

R. Knut[1], O. Sydorchuk[4], S. Ryabyi[1], Larysa Sydorchuk[2], Alla Khodorovska[3], A. Sydorchuk[2], O. Khomko[1], R. Sydorchuk[1*]

Higher State Educational Establishment of Ukraine
"Bukovinian State Medical University", Cernăuți, Ukraine
1. General Surgery Department
2. Family Medicine Department
3. Histology Department
"O. O. Bohomolets" National State Medical University, Kyiv, Ukraine
4. Oncology Department
[*]Corresponding author. E-mail: rsydorchuk@ukr.net

SUTURELESS FUNCTIONALLY ADAPTIVE FIXATION METHOD FOR INGUINAL HERNIOPLASTY (Abstract): Mesh fixation using glue instead of sutures for inguinal hernia (IH) repair has become popular during last decade. Existing literature database including multiple clinical trials is confusing, giving no exact answer whether mesh fixation with glue can reduce chronic pain without increasing the recurrence rate and/or causing other glue related side effects. **Aim:** To determine whether the use of glue to fix the mesh reduce pain, postoperative complications and 18 months reoccurrence rates after IH repair compared to Lichtenstein technique. Secondary objectives were to compare quality of life changes after sutured and glued mesh fixation. **Material and methods:** The study involved 94 primaries uncomplicated IH patients divided into 2 groups: control group of 71 (75.53%) patients, who underwent classic sutured Lichtenstein repair and study group of 23 (24.47%) patients with glued mesh fixation according to developed functionally adaptive fixation (FAF) technique combining albumin glue mesh fixation and mesh tailoring in accordance to anthropometric peculiarities. **Results:** Duration and expression of post-operative pain requiring painkillers, length of working capacity and physical activity restoration was shorter in study group compared to control. Quality of life according to SF-36 was better following FAF surgery, too. **Conclusions:** FAF demonstrated better or comparable results with less acute and chronic postoperative pain and better quality of life than sutures for Lichtenstein hernia repair. No FAF specific complications were demonstrated in this study. Further prospective studies are at need with wider cohort selection, better randomization, and standardization combined with different surgical glues assessment. **Keywords:** HERNIA REPAIR, INGUINAL HERNIA, GLUE, MESH FIXATION, PAIN, QUALITY OF LIFE, SUTURE.

Inguinal hernia (IH) is the most common abdominal wall hernia. IH account for about 75% of all abdominal wall hernias, with a lifetime risk of 27% in men and 3% in women; up to 50% of patients with IH are unaware of this condition and IH repair is one of the most commonly performed surgical procedures worldwide, with rates ranging from 10 per 100 000 of the population in the UK to 28 per 100 000 in the US.

IH are at risk of irreducibility or incarceration, which may result in strangulation and obstruction (1).

Risk factors for IH are well known, including gender, physical activity, and older age. However, similarly to other diseases, genetic predisposition to IH and connective tissue abnormalities in general (2) is discussed backed by both gender-associated nature of disease, modern morphological findings (3) and pathogenesis analogies with other conditions.

Conservative management and manual hernia reduction may be only applied in uncomplicated asymptomatic or minimally symptomatic IH (without or only minimal complaints). Surgery is the treatment of choice varying from currently outdated natural (own) tissue hernioplasty to Lichtenstein mesh and laparoscopic (TEP preferred to TAPP) repair. Non-mesh hernioplasty, according to EHS Guideline is only recommended for strangulated hernia repair in case of suspected infection. Endoscopic hernia repair requires both equipment end expertise, is comparatively expensive and more effective in bilateral IH. Compared with open repair, laparoscopic surgery for IH is associated with longer operation times, higher recurrence rates, but less severe postoperative pain, fewer complications, and more rapid return to normal activities. Tension-free Lichtenstein hernioplasty is comparatively simple, affordable and effective technique for IH repair; it has relatively low recurrence and complications rates, but several side effects (4). Most important of them, chronic groin pain syndrome may be a long-term problem related to mesh sutured fixation and operative trauma after Lichtenstein hernioplasty. Collection of blood or fluid, local inflammation and neuropathy are considered to be related to mesh and its fixation with sutures (5, 6).

As a result, mesh fixation using glue instead of sutures has become popular during last decade (7, 8). Existing literature database including multiple clinical trials is confusing, giving no exact answer whether mesh fixation with glue can reduce chronic pain without increasing the recurrence rate and/or causing other glue related side effects.

Therefore, *the aim of this study* was to determine whether the use of glue to fix the mesh instead of sutures reduce acute postoperative pain, postoperative complications, chronic pain and 18 months reoccurrence rates after IH repair compared to the own tissues and Lichtenstein technique. Secondary objectives were to compare quality of life changes after sutured and glued mesh fixation.

MATERIAL AND METHODS

The study involved 94 (mean age 34.17±6.49 yrs.) primary uncomplicated IH patients divided into two groups: *the control group* of 71 (75.53%) patients, who underwent classic sutured Lichtenstein repair and *study group* of 23 (24.47%) patients with glued mesh fixation according to developed functionally-adaptive fixation (FAF) technique. This study *conforms to international bioethical standards* (European Convention on Human Rights and Biomedicine, the Declaration of Helsinki of the World Medical Association on ethical principles of scientific medical research involving human subjects, GCP, EUC directive #609, etc.) and approved by Commission for Bioethics in Research of the Bukovinian State Medical University, Ukraine. All patients signed written permissions and obtained full information about the study prior to participation. Local anesthesia was combined with sedation and systemic painkillers (6).

Lichtenstein hernia repair (control group) performed with non-absorbable

polypropylene sutures for fixation of lightweight polypropylene mesh. FAF method (study group) included: -evaluation of patient's morphological type, determination of anthropometric indicators (abdominal indices, *distantia spinarum*, height of hypogastrium, and distances from the pubic symphysis to *spina iliaca* anterior superior and from the pubic tuberculum to the inguinal ring etc.), and assessment of anatomical peculiarities e.g. trauma or connective tissue conditions; use of albumin-based glue containing 45% albumin and 10% glutaraldehyde solutions in 4:1 proportions for mesh fixation. The *concept of FAF* method is based on use of albumin glue, less influencing local tissues compared to more common fibrin or cyanoacrylate glues (9, 10), but which may comparatively rapidly degrade due to local and systemic fibrinolysis (anti-fibrinolytic agents were added) stimulated by both surgical trauma, bleeding and grafting similarly to other surgeries (11); and tailoring the mesh according to anthropometric peculiarities of the patient, somehow similarly to E. Trabuco's technique (12). The last assists in keeping the mesh fixed on-site, providing additional *elastic fixation* by own tissues.

Set of clinical data including postoperative complications, pain syndrome, impact on physical capacity, and recurrence were evaluated by an independent blinded observer. SF-36 questionnaire was used for quality of life after hernioplasty assessment. *Statistical processing* was carried out using the *MS Excel* software.

RESULTS

Duration of post-operative pain requiring painkillers was slightly shorter in study group compared to control (tab. I). Pain, including chronic inguinal pain syndrome itself, paresthesia, and feeling of foreign body were the most common complication of hernioplasty in all groups. Higher than in control group percentage of fluid collection in study group (4.3% vs. 2.1% and 1.4%) is caused by smaller number of observations. Total number of fluid collections and wound suppurations was higher in suture group (control) compared to FAF (study group). Hernia reoccurrence rate for 18 months was minimal in both groups with minor differences between them.

TABLE I

Comparative evaluation of different inguinal hernioplasties (clinical data)

Indices	Control group (n=71)	Study group (n=23)
Duration of immediate post-operative pain (hrs.)	35.62±3.21	25.39±2.37 $p_1<0.05$
Restoration of basic physical activity (days)	1.80±0.22	1.71±0.35 p >0.05
Restoration of full working capacity (days)	31.12±2.27	30.17±3.62 p >0.05
Postoperative complications:		
- seromas	1 (1.4%)	1 (4.3%)
- hematomas	1 (1.4%)	–
- wound suppuration	1 (1.4%)	–
- paresthesia	6 (8.5%)	1 (4.3%)
- feeling of foreign body	11 (15.5%)	2 (8.6%)
- chronic inguinal pain syndrome	5 (7.0%)	–
- mesh deformation/dislocation	3 (4.2%)	1 (4.3%)
Hernia reoccurrence (18 months of observation)	1 (1.4%)	–

Notes: p – reliability of differences compared to control group data.

Use of surgical glue reliably improves physical activity and bodily pain indices (tab. II) during postoperative period. Other differences between both groups in other parts of SF-36 questionnaire were less significant including general health perceptions, vitality, and physical role functioning.

TABLE II

Quality of life after hernioplasty according to SF-36 questionnaire in different groups

Indices (points)	Control group (n=39)	II group (n=21)
Physical functioning	85.44±4.09	91.75±5.27 $p_1<0.05$
Bodily pain	84.73±3.91	90.22±5.27 $p_1<0.05$
Vitality	67.85±3.89	68.43±4.85 $p_1>0.05$
Social role functioning	86.41±5.41	86.64±4.18 $p_1>0.05$
Physical role functioning	82.28±4.31	81.46±3.84 $p_1>0.05$
Emotional role functioning	74.43±3.55	76.82±3.59 $p_1>0.05$
General health perceptions	87.46±4.77	87.33±4.34 $p_1>0.05$
Mental health	81.0±3.42	81.91±3.97 $p_1>0.05$

Notes: p – reliability of differences compared to control group data.

DISCUSSION

Tension-free IH repair is a method of choice since last decade. Use of mesh significantly simplified surgery itself, made it faster and safer, leading to very low recurrence rate. However, use of mesh for hernioplasty creates several conditions that may aggravate the outcome of surgery (8, 13). Among them chronic pain syndrome including pain itself, feeling of foreign body, and paresthesia (14) are the most common. Other mesh-associated postoperative complications not typical for surgery using own tissues are seromas, mesh dislocations and deformations.

Possible answer towards these issues is use of glue or anatomical structures for mesh fixation, which may potentially abolish conditions for mentioned above complications (5, 15).

However, suture-free E. Trabuco's technique requires specific graft and does not fully prevent chronic pain syndrome (4, 12). Most of existing comparative studies of use of glue for mesh fixation in groin hernioplasty demonstrate similar or better results compared to classic Lichtenstein technique proving its perspective, though both research bias, and differences of techniques may alleviate the value of obtained results (7).

In this study, we tried to combine both E. Trabuco's anatomical approach and use of other, previously unused glue for mesh fixation. While albumin glue is extensively used in cardiovascular surgery both as adhesive and sealant (9), due to its vulnerability against local fibrinolysis-proteolysis stimulated by both bleeding and surgical trauma including allotransplantation during hernioplasty, there was expectation of weaker mesh fixation compared to other techniques, leading to mesh dislocations, deformities, and higher recurrence rate. This study confirms similar or better results of FAF compared to I. Lichtenstein. Among FAF benefits facilitated chronic pain syndrome is the most important, lead-

ing to faster postoperative recovery and quality of life improvement.

CONCLUSIONS

FAF demonstrated significantly better results compared or comparable results with less acute and chronic postoperative pain and better quality of life than sutures for I. Lichtenstein hernia repair.

No FAF specific complications were demonstrated in this study. Further prospective studies are at need with wider cohort selection, better randomization, and standardization combined with different surgical glues assessment.

REFERENCES

1. Jenkins JT, O'Dwyer PJ. Inguinal hernias. *BMJ* 2008; 336(7638): 269-272.
2. Sydorchuk L, Yarynych Y, Knut R, *et al*. Hepatocytes' function and adipokines in patients with non-alcoholic fatty liver disease depending on the ACE (rs4646994) and PPAR-γ2 (rs1801282) genes' polymorphisms. *Rev Med Chir Soc Med Nat Iaşi* 2018; 122(2): 358-364.
3. Sidorchuk R. Laser polarimetry of conjuctive biotissue. *Proceedings of SPIE* 2002; 4705: 200-210.
4. Simons MP, Aufenacker ÆT, Bay-Nielsen ÆM, *et al*. European Hernia Society guidelines on the treatment of inguinal hernia in adult patients. *Hernia* 2009; 13: 343-403.
5. Damiano G, Gioviale MC, Palumbo VD, *et al*. Human fibrin glue sealing versus suture polypropylene fixation in Lichtenstein inguinal herniorrhaphy: a prospective observational study. *Chirurgia (Bucur)* 2014; 109: 660-663.
6. Paajanen H, Kössi J, Silvasti S, Hulmi T, Hakala T. Randomized clinical trial of tissue glue versus absorbable sutures for mesh fixation in local anaesthetic Lichtenstein hernia repair. *Br J Surg* 2011; 98(9): 1245-1251.
7. Lin H, Zhuang Z, Ma T, Sun X, Huang X, Li Y. A meta-analysis of randomized control trials assessing mesh fixation with glue versus suture in Lichtenstein inguinal hernia repair. *Medicine (Baltimore)* 2018; 97: 14(e0227).
8. Ronka K, Vironen J, Kossi J, *et al*. Randomized multicenter trial comparing glue fixation, self-gripping mesh, and suture fixation of mesh in Lichtenstein hernia repair (Finn Mesh Study). *Ann Surg* 2015; 262: 714-719.
9. Lisman A, Butruk B, Wasiak I, Ciach T. Dextran/Albumin hydrogel sealant for Dacron vascular prosthesis. *J Biomater Appl* 2014; 28(9): 1386-1396.
10. Hoyuela C, Juvany M, Carvajal F, *et al*. Randomized clinical trial of mesh fixation with glue or sutures for Lichtenstein hernia repair. *Br J Surg* 2017; 104(6): 688-694.
11. Pol'ovyĭ VP, Sydorchuk RI, Heorhitsa VM, Nurdinov KhN. Endoscopic treatment of hemorrhages in patients with ulcerative lesions of the gut. *Klinichna Khirurhiia* 2013; 3: 17-18.
12. Campanelli G, Bruni PG, Cavalli M, Morlacchi A. A Complete Sutureless, Hernia Repair for Primary Inguinal Hernia the Trabucco Repair: A Tribute to Ermanno Trabucco. *Surg Technol Int* 2016; 28: 141-146.
13. Sun P, Cheng X, Deng S, Hu Q, Sun Y, Zheng Q. Mesh fixation with glue versus suture for chronic pain and recurrence in Lichtenstein inguinal hernioplasty. *Cochrane Database Syst Rev* 2017; 2: CD010814.
14. Sydorchuk L, Tryniak M. Effect of voluntary regulation of the respiration on the functional state of the autonomic nervous system. *Lik Sprava* 2005; 1-2: 65-68.
15. Matikainen M, Kössi J, Silvasti S, Hulmi T, Paajanen H. Randomized clinical trial comparing cyanoacrylate glue versus suture fixation in Lichtenstein hernia repair: 7-Year Outcome Analysis. *World J Surg* 2017; 41(1): 108-113.