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MODERN APPROACHES TO COMPLETE PHYSICAL EXAMINATION AND TREATMENT OF PATIENTS WITH POSTOPERATIVE VENTRAL HERNIAS

Timeliness of the postoperative ventral hernia (PVH) issue is determined by both prevalence of this disease and poor results of surgical treatment. According to the data of Ukrainian and foreign literature 6-35% of patients have PVHs after laparotomy performed on the subject of various abdominal diseases (2). Mortality at operations on large and giant PVHs reaches 12-21% (4).

Nowadays PVH issue is considered as a complicated pluricausal condition characterized by local abdominal wall defect and determined by severe disorders concerning functions of many internal organs (4).

Patients with PVHs mainly get surgical interventions of two types: reparative that deals with complete adaptation of musculo-aponeurotic structures of abdominal wall to abdominal functional recovery; corrective that deals with preservation of fixed diastasis in musculo-aponeurotic layers. The patient's recovery and quality of his or her life also depends on the surgeon's choice of the most rational plastics type.

Under the conditions of modern surgery the extent of preoperative examination of the patients with PVHs, including physical examination of the patient, X-ray contrast testing of gastrointestinal tract and ultrasound scan, has certain disadvantages. Subjectivity, absence of concrete markers that are subject to further analysis, poor anatomico-functional state visualization of abdominal wall lead to data distortion in course of information communication from diagnostic part to the surgeon.

Object

of this research is the diagnostic quality improvement and the results of surgical treatment of PVHs by designing algorithm of the complex study of patients at preoperative stage.

Materials and techniques.

Treatment results of 135 patients who were operated at the Surgery of Kharkov Municipal Clinical Hospital №17 during 2008-2012 were studied.

All examined patients were divided into two groups.

The main group consists of 85 patients operated on the subject of medial hernias. The patients' age varied from 20 to 75 years. There were 50 women (58.8%) and

35 men (41.2%). In the structure of comorbidity cardiovascular and respiratory systems diseases prevailed. Thus, 6 patients (7.1%) had respiratory distress, and 35 patients (41.2%) had circulatory deficiency of various degrees. 6 patients (7.1%) experienced postinfarction cardiosclerosis and 4 (4.7%) – consequences of acute cerebrovascular accident. 40 patients (41.1%) were diagnosed with obesity of various degrees. 4 patients (4.7%) suffered from diabetes mellitus.

45 (52.9%) of 85 patients had primary PVHs, 40 patients (47.1%) had recurrent PVHs. 5 patients' (5.9%) PVHs recurred three times and more.

In anamnesis 15 patients (17.6%) were observed to have hernias less than three years; 35 patients (41.2%) had from three-year to ten-year hernias and 35 (41.2%) – more than ten-year hernias.

Most repeated causes for herniation were operations on the subject of gallstone disease – 25 cases (29.4%), and gynaecologic operations – 20 cases (23.5%). 10 patients' (11.8%) hernias appeared after operations on the subject of umbilical hernia; 10 (11.8%) – after relaparotomy on the subject of peritonitis; 10 (11.8%) – after operations on the subject of adhesive obstruction, and 10 more (11.8%) – after surgical interventions on the subject of large intestine oncopathology.

On the basis of hernial orifice size PVHs were divided into small – from 5 to 10 cm, large – from 10 to 15 cm, and giant – more than 15 cm.

10 patients (11.8%) had small hernias, 26 patients (30.5%) had medial hernias, 36 patients (42.4%) had large hernias and 13 patients (15.3%) had giant hernias.

Control set consisted of 50 patients with different pathology of abdominal cavity organs who didn't go through laparotomy. They were to be operated on the subject of the major disease. The patients' age varied from 21 to 75 years. 18 patients (36%) were younger than 50, 32 patients (64%) were from 51 to 75 years old. There were 35 women (70%) and 15 men (30%).

The main pathologies on the subject of which the operation was based were the following: gallstone disease and its complications of 16 patients (32%); stomach and duodenum diseases of 7 patients (14%); liver diseases of 10 patients (20%); pancreas diseases of 5 patients (10%) and intestines disease of 12 patients (24%).

Main and control sets were matched on the basis of sex, age, severity of pathological process and other clinical parameters.

Preoperational checkup consisted of objective patient examination techniques, laboratory tests, monitoring of cardiovascular system, spirogram and X-ray research.

During preoperational period 50 patients of the control set and 85 patients with PVHs went through ultrasound scan on Philips HD II apparatus with the help of linear, surface and sector probes with scan rate 3.5 – 7.5 MHz. Duplex scanning programs, color flow imaging of abdominal rectus muscle and energy mapping were used.

Study of Doppler topography aa. epigastrica superior et inferior was performed in abdominal rectus muscle to determine the view of vascular arrangement, paths of vessels, and preventive care to avoid vascular injuries during plastics. View of vascular arrangement was marked on the skin and taken into consideration when performing the operation.

To evaluate the index of peripheral resistance, the resistibility index (RI) and linear blood flow rate (LBFR) were determined.

The anterior abdominal wall and abdominal cavity organs state was examined to detect comorbidity. The following parameters of the hernia were studied: localization, size of hernial sac and its content, size of hernial orifices and their quantity, and also degenerative changes of abdominal wall musculo-aponeurotic structures.

Computer tomography was performed on Toshiba Acvilium 16 multispiral apparatus. The area of examination was limited to cupula of diaphragm and bones of pubic symphysis. Parameters of the examination are the following: interval between slices – 8 mm, section thickness – 10 mm.

In the control set of patients elements of abdominal wall were examined to detect age degenerative changes and abdominal cavity organs – on the subject of the major disease and revealing corresponding pathology.

Study concerning the abdominal wall state of patients with postoperative ventral hernias (PVHs) was conducted, it covered atrophy, adipose degeneration, and cicatricial deformity of the elements of musculo-aponeurotic layers; the following parameters of hernias were examined: localization, size of hernial sac and its content, size of hernial orifices and their size. Besides, state of abdominal cavity organs, retroperitoneal space and small pelvis were studied to reveal comorbidity.

Received data were analyzed with the help of the package of statistical analysis Statistica 6.1.

Results and discussion. In course of abdominal wall ultrasound scan 50 patients were diagnosed with expansion of subcutaneous fat with different degree of manifestation: in 15 cases (30%) its state was normal (not bigger than 2 cm), in 13 cases (26%) – moderate (from 2 to 4 cm) and in 22 cases (44%) – expressed (more than 4 cm). In course of palpation no defects in musculo-aponeurotic layer were found.

Ultrasound scan data showed that as the patients' age level grows degenerative changes affect those who didn't experience surgical interventions on abdominal wall at 50 and later that was observed in 30 cases (60%). 15 patients at the age starting from 60 were diagnosed with adipose degeneration (30%). 17 patients (34%) younger than 50 didn't experience any changes in abdominal rectus muscle.

Normal muscular tissue looked hypoechogenic with well-defined hyperechogenic parallel linear structures under longitudinal scanning and with punctulated pinholes of «starry sky» type in the transverse plane of the scanning representing connective in layers of perimysium. Thickness of rectus muscles was not less than 10 mm.

Ultrasound scan showed that atrophic changes were expressed in volume depletion of muscular tissue, thinning of muscles under examination for less than 10 mm. No expressed changes of muscular tissue of the patients belonging to the control set were revealed.

Ultrasound scan data are consistent with CT data. Degenerative changes of abdominal wall were not revealed in cases of patients under 50. Women have degenerative changes after 50, and men – after 60.

Men aged 60-75 and women aged 50 and older were diagnosed with adipose degeneration of abdominal wall muscles. Altogether 30 patients (60%) aged 50 and older had muscle atrophy, and 15 patients (30%) older than 60 had adipose degeneration.

Normal muscular tissue that was registered in 9 cases (18%) in course of ultrasound scanning and in 24 cases (48%) in course of CT looked homogeneous with sharp and smooth contours and had total density of 50-60 ea and thickness not less than 10 mm.

Weak degree of degenerative changes of abdominal wall rectus muscles was revealed in 24 cases (48%) at ultrasound scan and in 21 cases (42%) at CT; it was expressed in thinning of rectus muscles in axial sections of less than 8-10 mm, with total density of 40-50 HU and had inhomogeneous structure at the cost of low-density single inclusions.

Moderately expressed degenerative changes of abdominal rectus muscles are characterized by thinning up to 6-8 mm, total density of 20-40 HU at the cost of intramuscular fat and a large amount of grumous saccules. As a rule, muscle contours are irregular and visible along the entire length. Similar changes were revealed in the control set in 16 cases (32%) at ultrasound scan and in 13 cases (26%) in CT.

Expressed changes that were registered in 2 cases (4%) at ultrasound scan and in 13 cases (26%) at CT were characterized by muscle thickness not less than 6 mm up to filamentary structure with thickness of 1-2 mm. Density of muscular tissue in the last category was diffusively reduced to less than 20 HU and was inhomogeneous due to a small amount of small areas of preserved muscular tissue. Muscular fiber contours of are irregular. This distinction in received data of ultrasound scan and CT is explained by limited sensation of ultrasound scan method. In this way the regularity concerning age level increase and degenerative changes aggravation of abdominal wall elements in cases of patients who didn't go through laparotomy was revealed.

Topography Doppler ultrasound scan of epigastric vessels belonging to anterior abdominal wall did not show significant abnormalities.

According to our observations the diameter of epigastric vessels of abdominal rectus muscle did not vary regardless of the patients' age. Average diameter a. epigastrica superior was 1.71 ± 0.11 mm; v. epigastrica superior 1.9 ± 0.21 mm; a. epigastrica inferior – 2.6 ± 0.13 mm, v. epigastrica inferior – 3.6 ± 0.21 mm.

Blood velocity in epigastric vessels of patients with expressed degenerative changes of abdominal rectus muscles is positively lower than those of patients without degenerative changes or with moderate ones ($p < 0,05$), i.e. there is a direct connection between the degree of atrophy of musculo-aponeurotic structures and blood velocity.

Average value of LBFR in epigastric arteries of abdominal rectus muscle of patients with normal muscular tissue was 10.3 m/s in systole and 3.2 m/s in diastole. Reduction of speed was registered in 13 cases (26%) of patients with expressed abdominal wall elements degenerative changes. Patients with obesity, diabetes mellitus and aged patients had more expressed Doppler abnormalities (7.9 m/s in systole and 2.6 m/s in diastole).

Average value of RI in arteries of patients who did not have degenerative changes or who had a minor degree of degenerative changes of abdominal rectus muscles was 0.62 ± 0.016 m/s. RI of patients who had expressed degenerative changes increased to more than 0.7 m/s and reached 0.72 ± 0.028 m/s.

In this way, the degree of arterial blood flow depression directly depends on the degree of degenerative changes in musculo-aponeurotic structures of anterior abdominal wall.

Comparing degenerative changes in anterior abdominal wall musculo-aponeurotic layers of patients with hernias we revealed more expressed degenerative changes. It was discovered that changes expressiveness depends on size of a hernia and duration of having it. Patients who had hernias for less than 3 years had weak degrees of degenerative changes in 4 cases (8%), moderate – in 2 (4%), and there were not registered any expressed changes.

Patients with disease duration from 3 to 10 years had weak degree of degenerative changes in 8 cases (16%), moderate – in 4 (8%), and expressed – in 2 (4%).

The degenerative changes degree of patients who had hernias for more than 10 years reached 12%, 10% and 8% correspondingly.

It is necessary to observe that in the group of patients with small hernias degenerative changes were not registered, in the group of patients with medial hernias degenerative changes were revealed in 2 cases (4%).

Patients with large hernias had degenerative changes in 10 cases (20%) and with giant – in 7 (8.2%, that is 8.2% of the general group and 46.7% of the group with this pathology).

The bigger the hernia is the more expressed are degenerative changes.

Blood velocity in epigastric vessels of patients with large and giant PVHs is positively lower ($p < 0.05$). Values of LBFR of patients with large and giant PVHs changed to the deterioration of arterial blood flow – 6.4 m/s in systole and 2.1 m/s in diastole. Average value of RI in this category increased to more than 0.7 m/s, and reached 0.75 ± 0.028 m/s.

In this way, deterioration degree of arterial blood flow has a direct connection with duration of having a hernia, size of hernial sac and hernial orifices, i.e. with the degree of degenerative changes in anterior abdominal wall musculo-aponeurotic structures.

According to the data of clinical examination, 7 patients (8.2%) were assigned to the group of patients with small hernias. 21 (24.7%) – to the group of patients with medial hernias, 30 (35.3%) – to the group of patients with large hernias, 27 (31.7%) – to the group of patients with giant hernias.

Studying sizes of hernial orifices through ultrasound scan showed that in 47 cases (55.3%) hernial orifices were not bigger than 10 cm. According to the ultrasound scan data hernial orifices of 13 patients (15.3%) with large and giant PVHs were not bigger than 15 cm.

CT data show that sizes of hernial orifices were smaller than 5 cm in 15 cases (30 %), smaller than 10 cm – in 16 (32 %), from 10 to 15 cm – in 11 (22%), and more than 15 cm – in 8 (16 %).

In this way, we revealed inconformity of clinical examination data with ultrasound scan and CT data. The latest techniques of research provide with a possibility to estimate the size of hernial sac more accurately. Besides, absence of regularity between the size of hernial orifices and the size of hernial sac was revealed.

Conclusions.

1. Allowable radiation exposure, high degree of information content, accurate localization diagnosis, simplicity of performing ultrasound Doppler scan and computer tomography let them take a leading position in diagnosis of postoperative ventral hernias.

2. Usage of modern techniques in examination of patients with PVHs allow to get accurate image of sizes of hernial orifices and hernial sac, expressiveness of degenerative changes in anterior abdominal wall musculo-aponeurotic structures, determine topography of epigastric vessels and characteristics of blood flow in them at preoperative stage.

3. Diagnostic criteria described above give a surgeon the possibility to choose correctly the method of anterior abdominal wall repairing and correspondingly reduce the amount of early postoperative complications and relapses in remote period.

List of references

1. C. Geo. Post-operative ventral hernia, its causes and prevention. California state journal of medicine, 50, 750-765.
2. M. Ben-Haim, J. Kuriansky Pitfalls and complications with laparoscopic intraperitoneal expanded polytetrafluoroethylene patch repair of postoperative ventral hernia./ Surgical Endoscopy and Other Interventional Techniques, May 2002, Volume 16, Issue 5, pp 785-788
3. Carbajo MA, Martin del Olmo JC, Blanco JI, et al. Laparoscopic treatment vs open surgery in the solution of major incisional and abdominal wall hernias with mesh. Surg Endosc. 1999;13:250–252.
4. Heniford B, Park A, Ramshaw BJ, Voller G. Laparoscopic ventral and incisional hernia repair in 407 patients. J Am Coll Surg. 2000;190:645–650.
5. Eid GM, Prince JM, Mattar SG, Hamad G, Ikramuddin SI, Schauer PR. Medium-term follow-up confirms the safety and durability of laparoscopic ventral hernia repair with PTFE. Surgery. 2003;143:599–604.
6. Carbajo MA, Martin del Olmo JC, Blanco JI, et al. Laparoscopic approach to incisional hernia. Lessons learned from 270 patients over 8 years. Surg Endosc. 2003;17:118–122.

7. Gillian GK, Geis WP, Grover G. Laparoscopic incisional and ventral hernia repair (LIVH): an evolving outpatient technique. *JLS*. 2002;6:315–322.
8. Berger D, Bientzle M, Muller A. Postoperative complications after laparoscopic incisional hernia repair. *Surg Endosc*. 2002;16:1720–1723.
9. Heniford BT, Park A, Ramshaw BJ, Voeller G. Laparoscopic repair of ventral hernias. Nine years' experience with 850 consecutive hernias. *Ann Surg*. 2003;238:391–400.
10. Van't Riet M, van Steenwijk PJ, Kleinrensink GJ, Steyerberg EW, Bonjer HJ. Tensile strength of mesh fixation methods in laparoscopic incisional hernia repair. *Surg Endosc*. 2002;16:1713–1716.