



Current state and problems of the treatment of giant postoperative ventral hernias Literature review

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Abstract

Methods of treatment of giant postoperative ventral hernias and their complications are constantly updating, by the necessity to reduce the number of postoperative complications, recurrence and death. The article presents an overview of the foreign and domestic literature on the surgical treatment of giant postoperative hernias in modern herniology.

Keywords: intraabdominal pressure, abdominal compartment syndrome, endoprosthesis, anterior abdominal wall

Introduction

Despite the rapid development of minimally invasive technologies endovideosurgical Abdominal Surgery, the number of surgical procedures using conventional laparotomy access is high, after which in 4-18% of cases developed postoperative ventral hernia (POVH), and in general the statistical structure of ventral hernias account for 20 POVH 26% [3, 14]. The structure of all abdominal hernias large postoperative hernia (LPOVH) occupy a special place, and they account for between 3 and 14% [11]. About 60% of patients with POVH - aged between 21 and 60 years, i.e., are a significant part of the working population [7, 26].

Results POVH treatment characterized by a rather high number of relapses (from 4.3 to 46%) [8, 9], and for LPOVH relapses reach 60% of cases [10, 23].

Cause of POVH in 31,4-63,4% are infectious processes in the wound [11], in 35.1% - drainage and tamponade abdominal wound through the main [24], and 40,7% - eventration [4]. Only 18% of hernias development occurs against favorable postoperative period [19]. But even with a favorable course wounds - POVH develop in patients with an imbalance of collagen type III, which leads to progressive tissue morphofunctional insufficiency that is characteristic for most patients with recurrent hernias, with subsequent development of their "Hernial disease" [6, 14].

The increasing incidence of POVH associated with increased amounts of elderly patients with their characteristic heavy accompanying somatic pathology - chronic respiratory diseases, circulatory system, urinary system, as well as chronic constipation and metabolic diseases (diabetes, obesity, hypothyroidism) [4, 17].

In the pathogenesis of POVH and relapses important role belongs to obesity. When morbid obesity risk POVH after uncomplicated laparotomies is increased 2-fold, reaching 28-30%. Among all patients with LPOVH overweight or obesity is found in 70-90% of cases [8, 19]. According to the literature, most POVH occur after gynecological surgery (26 to 50% of

cases), operations in the bile ducts (20 to 30%) over the stomach and duodenum (approximately 12%), appendectomies (6 to 14%), abdominal wounds and injuries (about 9%) [5, 23]. Mortality after surgical interventions on the LPOVH reaches 10% [23].

Over the past decade, scientists have been many attempts to systematize and classify POVH as a separate nosological unit. Some authors tried to "sort" ventral hernia, depending on their size, by using two basic parameters - the length and width, and the other - the proposed classification based on the magnitude square lesions pushing rather complex formula [17, 29].

V.N. Egiev modified classification K.D. Toskin and V.V. Jebrovskiy (1990). According to this classification, the size of postoperative hernias and their location is determined relative to the abdominal area, and are divided in size [27]:

- Small - 1 region of the stomach;
- Medium - 2 abdominal area;
- Large - 3 abdominal area;
- Giant - more than 3 areas of the abdomen.

Localization hernia is defined by their relationship to the abdomen. If the hernia has more than one area, its location is determined by the region where it is most of the [28].

It should be noted that the size of the herniation often do not match the size of hernial ring. With a fairly large hernia can occur relatively small hernial ring and, on the contrary, when the average value of a hernia - large enough for the total area of cellular defects in the musculo-aponeurotic layer [8]. However, as a rule, at large, giant and recurrent hernias, even if the hernia defect is small, the surrounding tissue will change dramatically, resulting in a thinning of the fascia and muscle due to atrophy, degeneration and scarring [7, 28].

Currently, the classification is used more often the SWR (*size bed, windlass, relapse*), developed of J.P. Chevrel and A.M. Rath and adopted at the XXI International Congress herniology in 1999 in Madrid, which takes into account the following parameters:

S - localization of a hernia

1. Median hernia (M - midline)
 - M₁ - above the navel
 - M₂ - paraumbilical
 - M₃ - under the navel
 - M₄ - suprapubic
2. Side hernia (L - lateral)
 - Of L₁ - infracostal
 - L₂ - transverse
 - L₃ - iliac
 - Of L₄ - lumbar
3. Combined (ML)

W - width hernial ring

- W₁ - less than 5 cm
- W₂ - of 5 to 10 cm
- W₃ - from 10 to 15 cm
- W₄ - more than 15 cm

R - The number of preceding recurrences

- The R₀ - this hernia first
- R₁ - first relapse
- R₂ - second relapse
- R₃ - third relapse etc.

Performs earlier ways of plastics

- An RA - simple suturing of the defect
- MP - plastic with muscle
- Of PR - explantation synthetic prosthesis.

According to this classification hernia W₃ and W₄ are large and giant, respectively. Using this classification allows, conducts statistical reliability study the relationships between different groups of patients and recurrence percentage [3, 25]. Modern surgery has at its disposal a large arsenal of various operational procedures hernia repair ventral hernias local fabrics. Autoplasty methods quite well disclosed in the literature and substantiated. However, any kind of musculo-aponeurotic plastics leads to excessive tension of the tissues involved in closing the defect, which further leads to degeneration and atrophy, especially in cases LPOVH [15].

At the end of XX and at the beginning of the XXI century. as a method for the surgical treatment of autoplasty POVH, especially LPOVH, it has become a widely used method auto-dermoplasty, where the plastic material is used a flap of the patient's own skin. Introduction auto-dermoplasty the treatment POVH contributed developed by Professor V.N. Yanov (2000) a method of treating a skin graft as a plastic material [16].

Several authors have proposed various embodiments auto-dermoplasty: auto-dermal monophilic plastic by "pinching": auto-skin - monofilament plastic flap auto-dermal monophilic plastic corrugated flap and combined methods hernioplasty [3]. The authors believe this technique that autoplasty own tissues has low immunological reactivity, is not rejected, causes no local inflammation reaction. At the same time auto-dermoplasty associated with large traumatic in connection with the graft wall. Relapses at auto dermoplasty POVH reach 12%, and the incidence of wound complications (WC) in the application of skin patches is 3-8% [3, 17].

Currently, due to the introduction into clinical practice of modern biocompatible implants auto-dermoplasty at LPOVH used less and less [3, 28]. To date, the surgical treatment of POVH, especially LPOVH, the method of choice is all genioplasty using mesh implants. According to McCormack K. The *et al.* (2003), the main advantage of allogeneic plastics anterior abdominal wall (AAW) is to reduce the number of relapses by 20-50% and the general possibility of treating patients with large and giant hernias. Implementation non-tension methods allo genioplasty for large and giant hernias possible to improve the results of surgery and improve the quality of life of patients in the postoperative period [18, 21].

The main requirements to synthetic endoprostheses, which are used for hernia repair, many authors have concluded that they must possess a number of mandatory features: - flexibility, so as not to cause pressure sores adjacent tissues; - resistant to the effects of infection and tissue fluids; - not cause marked inflammatory reactions; - porosity for infiltration of macrophages, fibroblasts, blood vessels in the pores; - mechanical strength and integrity for a long time; - should not have carcinogenic [6, 14]. Select synthetic endoprosthesis has a significant impact on the incidence of wound complications (WC) at LPOVH. Because the physical properties of modern materials the greatest importance for the prophylaxis WC have porosity of the prosthesis and pore sizes. Average microbial equals 1 micron dimensions, whereas the average size exceeds 10 microns phagocytes and they can't penetrate the implants in which a pore size of less than 10 micron [19].

A.G. Amid suggested that the most common classification of biomaterials, and divided them into four types based on the size of the pores [19]:

Type I: Totally macroporous prostheses (Atrium, Marlex, Composix, Prolene, Surgipro, Trilex) pore sizes are greater than 75 microns and a fully "transparent" to macrophages, neutrophils, fibroblasts, collagen fibers, capillaries and freely comprise macrophages, fibroblasts, neutrophils capillaries, and collagen fibers.

Type II: Totally microporous prostheses such as stretched polytetrafluoroethylene - Gore-Tex, e-PTFE. Pore size in which less than 10 microns in one of the three dimensions.

Type III: Macroporous prostheses with multifilament or microporous components, such as polytetrafluoroethylene mesh (Teflon), woven Dacron mesh (Mersilen), woven polypropylene mesh (Surgipro) and perforated polytetrafluoroethylene (Mycro-Mesh).

Type IV: Biomaterials with submicroscopic pores, such as Silastic, Cellgard (polypropylene fabric), and specially prepared plate pericardium or dura - Preclude Pricardial membrane, Preclude Dura Substitute. Recent plastics are unsuitable for hernia defects, however, in combination with type I prostheses can be used for intraperitoneal implantation. Prostheses I type are less suitable for vegetation microbes and suppuration they can be left in their bed on the background, and adequate drainage of antibiotic [21].

According to some authors, the second and third types of prostheses, like braided suture materials are able to retain a

bacteria and provoke an inflammatory response^[26]. In the case of type II prosthesis complete removal of the implant is necessary to save the patient's life^[22].

All modern synthetic implants meet the biocompatibility criteria. Considered the most versatile polytetrafluoroethylene polypropylene and polyester. All of these prostheses is well germinate connective tissue and colleganic fibers promote tissue migration of fibroblasts, inert, non-carcinogenic and do not cause allergic reactions. Polytetrafluoroethylene can be implanted into the abdominal cavity, the peritoneum is not hiding - for a prosthesis surface a thin quickly mesothelial-cell layer providing peritonization^[23]. The combination of all the necessary qualities of cheapness was the prerequisite for the widespread use of polypropylene.

R. Stoppa and others have identified the most important principles that need to guide the hernia repair using mesh prosthesis. The most important one is: you must give preference to soft grid; if necessary cutting out grid to grid overlaps with excess hernia defect; optimally - the establishment of a prosthesis on endoabdominal fascia under the case of direct abdominal muscles; fix prosthesis few seams and use the grid in the presence of infection; in the case of festering - how can early and thorough brushing, do not rush to remove the grid in the case where the holes in it provide adequate drainage; antibiotic mandatory to the operation; prophylaxis of thrombosis and embolisms^[13]. In addition to choosing the synthetic material in the surgical treatment of POVH affect embodiments implantation of the endoprosthesis.

Currently, depending on the implant position in relation to the musculo-aponeurotic layer of BSS are the following non-tension ways hernia repair: over aponeurosis - on lay; retro-muscular - the sub lay; in the form of patches - in lay^[9, 18].

When the procedure on lay prosthesis is fixed on top stitched in the manner of the primary weld, hernial ring. When this grid is placed on the fascia and is fixed thereto around the perimeter hernial ring some distance from the edge by no less than 1.5-2.5 cm. The advantage of this method is that it is technically the simplest and thus the absence of the prosthesis in contact with the abdominal organs cavity^[8].

However, many authors have reported a relatively high probability of PO which frequency according to different authors ranges from 6 to 50%^[20]. This is because the installation of the prosthesis on lay method, the implant is in direct contact with subcutaneous fat (VLS). When VLS mobilization of aponeurosis at great distance (5-6 cm in each direction) are damaged lymphatic tract and a cavity wherein accumulate seroma, hematoma^[30].

Relapses when on lay plastic according to various authors reach up to 18% of cases. This is due to the fact that the bodies migrate through BSS securely fixed layers in sub-prosthetic space and the successive detachment^[15].

For the first time in 1973 Stoppa and Rives described a technique the sub lay. The prosthesis in this method is disposed between the muscle and aponeurotic muscle tissue behind distance of 5-6 cm from the edge of the defect and provides sufficient contact with the tissues of preventing excessive wrinkling prosthesis^[4]. Application of this method allows for PBS defect reconstruction and restore its physiological function. But this procedure is often difficulties

associated with isolation of the internal organs of the implant. The frequency of relapses in sub lay technique according to the literature is 12%^[16], and the frequency retention postoperative complications ranges from 20 to 45.8%^[14].

In lay technique involves the closing of the hernial defect directly BSS mesh implant of a patch circumference. Net endoprosthesis is located under the aponeurosis, the edges of the defect is not connected to the grid. In this hernial sac of anterior peritoneal tissue is separated from the fascia to the creation of "pockets" at a distance of 3-4 cm from the edge of the hernias ring^[12]. This equipment does not fully meet the requirements of the tension plastics and retains the same volume of the abdominal cavity. Nevertheless, when this technique is not always possible to completely isolate the bowel loops of the mesh implant peritoneum or omentum and subsequently arise not desirable complication^[17].

According to different authors recurrence rate when in lay plastic is 3-44%^[30]. Besides the above methods allo-hernioplasty exist and combined methods. This defined set of methods hernia repair, which is usually used in the AAW giant defects, and also at high risk of intra-abdominal hypertension and includes moving a patient's own tissues (individual sections or rectus abdominis aponeurosis of the external oblique muscle) and implanting an endoprosthesis^[14]. Describes layout options of one half of the prosthesis over the aponeurosis, the other - under it. These techniques solve a number of problems, but rather a complex and traumatic^[26]. Method combined alloplasty AAW without opening the abdominal cavity, the proposed Devlin in 1993 year, is the placement of the prosthesis in front of the musculo-aponeurotic layer with minimum tension hernias defect edges^[26]. The advantage of this method is the lack of plastic need to cut all the layers of the AAW and the opening of the abdominal cavity, and therefore decreases the likelihood of developing complications from the internal organs. However, this method has the following disadvantages: a high risk of complications, characteristic for subcutaneous implant arrangement (seroma, hematoma, infiltration), the impossibility of application of this plastic at POVH defective aponeurosis more than 10 cm.

In 1990 Ramirez proposed original method LPOVH plastics by separation of the anatomic components of the anterior abdominal wall, known as «Components separation method»^[15, 30]. The opening of the abdominal cavity and the treatment of the hernial sac are carried out in a manner analogous to plastic with the closure of the abdominal wall defect with synthetic material. The further course of the operation is determined by the need to not only close the defect in the abdominal wall, but also to restore the reduced volume of the abdominal cavity. The reason for the reduction of the abdominal cavity volume is contracture lateral muscles of the abdomen, resulting in the displacement of laterally sheath of the rectus muscles. The leading role in this process belongs to the external oblique abdominal muscle. As a result, the plastic abdominal wall is impossible, not only to bring together the rectus muscles of the vagina, but also straighten the contents of the hernia sac into the abdominal cavity due to a significant reduction of its volume. Recovery volume abdominal cavity during this procedure is accomplished by the mobilization of the hernia sac and the front leaf sheaths recti Up to the Spiegel

line on both sides. After this, at the level of the transition of the outer oblique muscles of the abdomen to their tendon part they intersect from the costal arch to the ilium. As a result, it is possible not only to reduce the size of the defect, but also to increase the volume of the abdominal cavity. A feature of the mobilization of the sheaths of the rectus muscles is a complete preservation of their blood supply and innervation, which allows, when they are moved medially, to a greater or lesser extent, to restore their function [25].

The advantage of this method is still plastic and the fact that it helps to strengthen the AAW for large and giant postoperative ventral hernias [30]. The disadvantage of the technique is the frequent accumulation of serous fluid, as a result of the intersection of many lymphatic and blood capillaries and the resulting detachment of subcutaneous fat base, as well as a contact with the subcutaneous adipose tissue arthroplasty [25]. Nowadays increasingly popular intraperitoneal way to the location of the prosthesis, especially with the use of laparoscopic techniques. To carry out such operations requires endoprosthesis with an adhesive barrier or composite mesh with anti-adhesive surface [30].

Several authors (Heniford BT. *et al.* 2000; Aura T. *et al.* 2002; LeBlanc KA. *et al.* 2003; Dumanian G.A., Denham W., 2003; Franklin M.E. *et al.* 2004) find that in laparoscopic hernia repair may be a significant decrease PO frequency. A significant drawback of the method is restoring the normal anatomy absence BSS [24].

The use of synthetic materials for the restoration PBS defects is not something new, but still the ideal material remains unfound. The implant is inserted into the patient's tissue still remains for him a foreign body, which causes the development of complications [22].

Frequency after PO plastics hernias anterior abdominal wall, according to various authors, varies in the range from 9 to 46% [3, 28]. PO main allogeneic implantation AAW walls are seroma (from 6.7 to 50%), infiltration (from 1.6 to 4.1%), purulent inflammation after surgical wounds (from 2.2 to 7.8%), the formation of fistula, graft rejection [27]. When implanting prostheses in the abdominal wall tissue exudative reaction is inevitable, however, some authors consider the development of not gray as a complication, and as an inevitable time of allogeneic AAW Plastics [19].

Contact during the operation with the old ligatures, inflammatory infiltrates and ligature abscess (the phenomenon of dormant infection) that remain after surgeries, erosion, maceration, skin ulcers in the hernia sac, the contact with the lumen of hollow organs during viscerolysis increase the risk of wound infection [13, 30]. Due to the wide separation of the anatomical structures of the abdominal wall are formed a large void spaces, thereby creating favorable conditions for the development of microflora [28].

One of the contributing factors is the occurrence of ischemia PO skin and VLS in the surgical wound is excessively separated from the underlying fascia. According to M.V. Kolokoltsev with colleagues (1974), mobilization of skin and subcutaneous fat in a $\frac{1}{2}$ -width straight muscles of the abdominal wall promotes ischemic wound edges. When allogeneic hernioplasty found more complications such as intestinal fistula formed due arrosion prosthesis; displacement of the implant in a hollow organ lumen; cyst of per-prosthetic

tissue; recurrent hernia associated with the mesh gap; adhesive intestinal obstruction associated implant adhesion to the gut, which are not observed in autoplasty [22].

Adhesive process occurs after any surgical intervention in the abdominal cavity, but in the presence of a foreign body, which is either a synthetic implant, the severity of these processes increases dramatically [25].

One comorbidities worsening of hernioplasty with, LPOVH is obesity. Patients with morbid obesity are significantly higher intra-abdominal pressure as compared to patients without obesity [23]. Obese relapse 2.5 times more likely than patients without obesity. S. Sauerland *et al.* (2004) on the basis of a randomized study in univariant and multivariate analysis showed that obesity ($BMI \geq 30 \text{ kg/m}^2$) is a risk factor for relapse POVH. Influence of obesity may be due to several factors: congenital defect connective tissue synthesis; increased intra-abdominal pressure, more complicated operation technique [26].

The inflammatory process in obesity as a response body reaction starts directly into adipocytes. The main link in the pathogenesis of this disease is very fat tissue that has endo, auto - and paracrine functions, and supports the development of subclinical inflammation [29]. In experimental studies when the mesh implant in patients with obesity in primary infected tissues recorded by excessive proliferation of granulation tissue with increased formation of interstitial collagen amid modified immune responses in a breach of the ratio between CD_4 and CD_8 lymphocytes, reducing the number of T-helper cells, the synthesis activation Ig G and M, macrophage amplification reaction [24].

Thus, the treatment LPOVH on the background of already available suppression of the immune system caused by a chronic inflammatory process of both local and systemic nature mesh implantation leads to further suppression of immunity, which is clinically manifested development of inflammatory complications in the wound [26]. In this regard, the prevention of allogeneic WC plastic abdominal wall in patients with LPOVH with concomitant diseases and obesity - a strategic issue of complex surgical treatment [23].

The main point in treating aggravating LPOVH is to increase intra-abdominal pressure when immersed hernial contents into the peritoneal cavity and crosslinking hernial ring, which takes place after each hernioplasty. Concomitant chronic somatic pathology complicates the situation, contributes to the development of severe complications in the postoperative period [26]. Such complications include abdominal hypertension syndrome, or abdominal compression syndrome (ACS), a long compression viscera syndrome, cardio-pulmonary insufficiency, and thromboembolic complications. In conducting plastics large defects PBS, this problem becomes catastrophic times. [25] Pathological changes that occur in acute and excessive increase in abdominal pressure (IAP) lead to the development of ACS. In addition to cardiovascular disease, high IAP creates an additional burden on the seam, associating tissues. Moreover, the latter acquires cutting properties formed around ligatures necrosis zone, and subsequently re-weld overlay impossible. When plastic median POVH maximum effort in the seams reach 70-80 N (Newton) and eruption occurs already at a force of 35 N [30]. Mounted directly proportional relationship between the

magnitude of IAP and body mass index (BMI) of patients - correlation is 0.4-0.5; as well as between age and the value IAP - correlated 0.7 [21]. Of great importance is the slow rate IAP [10]. According to many authors, abdominal compression syndrome occurs at a value IAP exceeding 20-25 mm Hg. v., and at IAP than 35 mm Hg. Art. ACS developed in 100% of cases without decompression lethal [22]. The greater the value of IAP and weaker the body, the greater the likelihood of developing ACS. The standard sequence of events when ACS after hernioplasty large abdominal wall defects: reduction of the volume of the abdomen → compression and internal organs to ischemia shock → development → massive fluid therapy reperfusion edema viscera → → ACS intraabdominal hypertension.

Mortality due to ACS reaches 42-68%, and the untreated mortality reaches 100% of the cases [40]. Along with the ACS severity of postoperative organs leads to prolonged compression syndrome in which the insides lose their normal location in the abdominal cavity, especially in patients with BPOVH [27].

There are three degrees of compression syndrome long bodies 1 degree - hernial sac volume content is up to 10% of the volume of the abdominal cavity; 2nd degree - 10 to 20%; Grade 3 - more than 20% by volume of the abdominal cavity.

In the development of long-term compression of internal organs syndrome plays an important role change in the IAP and moving bodies from the hernia sac into the abdominal cavity. When POVH through the abdominal wall defect located internal organs, and this leads to a stretching of the bowel mesentery, change architectonic viscera. Symptom "inflection" of the internal organs in the field of hernia gate leads to circulatory problems. First of all, there is the difficulty of venous outflow, which leads to venous stasis hernia contents tissues. Therefore, the dislocation of internal organs, the redistribution of IAP result in significant dysfunction of internal organs field operations, first of all - it is the complications of the respiratory and cardiovascular systems, and a high risk of thrombosis and thromboembolism [29].

In the development of the ACS plays elongation value of the abdominal wall, and the significant role played by the elasticity of the abdominal pain and in case of agitated patients [4, 21]. In turn acute p / o pain increases the rigidity of the respiratory muscles of the chest and abdominal wall, which leads to disruption of respiratory function: a decrease in tidal volume, vital capacity, functional residual capacity and alveolar ventilation [20]. Pain syndrome difficult expectoration, violates the evacuation of bronchial secretions, which helps without airiness and creates favorable conditions for the development of lung infection [5, 20]. Postoperative pain is a factor in inducing the development of surgical stress response, representing the totality of the endocrine, metabolic and inflammatory processes have evolved in response to the surgical trauma and pain, leading to disruption of normal activity of all vital functional systems. Reaction to stress and trauma manifested pulmonary dysfunction, cardiovascular, gastrointestinal systems, as well as neuroendocrine and metabolic disorders [24].

The massive tissue damage during abdominal surgery accompanied by an increase of catecholamines, which induce

degradation of glycogen in liver and muscles, and subsequently increased plasma levels of glucose and lactate. In turn, the insulin concentration may be reduced immediately after induction of anesthesia and then, during the operation that leads to a catabolic reaction hyperglycemic body [21].

Thus, a deficiency in insulin secretion and increase in blood glucose levels during operation is proportional to volume surgical trauma intensity. Postoperative hyperglycemia increases the risk of wound infection [29].

The impossibility of early activation of patients on a background of inadequate analgesia also increases the risk of venous thrombotic events [11]. Analysis of the literature shows the outcome of surgical treatment POVH depends not only on local factors in the lesion, but also the general state of the microorganism, its ability to overcome the violations that were caused by the surgery. Reduction of reparative abilities of the organism leads to a variety of complications, postoperative course aggravating and worsening wound healing sealed seams. To help the patient with these disorders can be achieved by adequate wound drainage and destination various drugs that can reduce the damaging effect of surgical trauma, shorten phase traumatic inflammation, enhance regenerative processes in the regeneration step, as well as increase the specific and the specific resistance of the organism to infection.

As indicated above, the more massive tissue damage, the more pronounced inflammatory reaction and accompanying intensity after surgery pain syndrome, which is a trigger for the surgical stress response and causes various dysfunctions of various organs and systems. It follows a logical conclusion that adequate analgesia can improve the outcome of surgical treatment. An alternative and effective method of pain relief is constant irrigation local anesthetic wound in the postoperative period. Application of single bolus inefficiently due to limited time action. Prolonged administration of drugs is carried out through a special catheter inserted by the surgeon in the desired location at the end of surgery, thus increasing the duration of analgesia and, consequently, efficient use of local tissue infiltration. This technique allows the use of a long wound irrigation, as a component of postoperative analgesia after implantation of a polypropylene mesh prosthesis after POVH plastics.

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