Biliary- Cutaneous and Entero-Cutaneous Fistulas Associated with Extensive Abdominal Wound Following Blunt Abdominal Trauma Treated with Negative Pressure Wound Therapy (NPWT)

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Abstract — Biliary- cutaneous fistula (BCF) is a rare complication of blunt abdominal trauma. Although, many techniques have been developed so far, management of BCF still remains an extremely challenging procedure. Management of biliary- cutaneous fistula requires a complex approach and collaboration of varying medical specialists. Poor general condition of the patient complicated with sepsis, past history of many laparotomies resulting in extensive abdominal wall defects contribute to an increased mortality rate. We present a case of bile duct injury complicated with bile- cutaneous fistula following blunt abdominal trauma treated with Negative Pressure Wound Therapy (NPWT). Due to the lack of potential and effective surgical methods of management, persisting bile leakage and the presence of high output enterocutaneous fistulas, NPWT is considered a method of choice.

Keywords — npwt – vacuum therapy – biliary-cutaneous fistula – enterocutaneous fistula – open abdomen.

I. INTRODUCTION

Iatrogenic causes are the most common reason for bile duct injury (BDI) [1]. Biliary duct injury is a rare occurrence following blunt trauma of the abdominal cavity, reported between 1-5% [2]. Injury affecting the common bile duct is the most common amongst biliary tract injuries, excluding gall bladder injury [3]. The common bile duct disturbances is a complication which usually is concomitant with liver rupture in 50- 80% of cases or failure of other internal organs [4]. The surgical strategy depends on many factors, such as level of bile duct injury, nature of injury, extent of laceration, concomitant injuries and the general condition of the patient [5]. Regardless of surgical management of primary repair due to the abdominal trauma, results are still not satisfactory with biliary complication rates of 20% and mortality rates of 17% [3]. The rate of biliary complication for reoperations is significantly higher standing at around 50% [3]. Presence of biliary- cutaneous fistula is very rare. Surgical procedures concerning bile fistulas are highly challenging. Moreover, there is no clear algorithm to provide this kind of disturbances. There are still many concerns and controversies regarding this problem. In this paper, we present the successful management of a complicated abdominal wound with a biliary cutaneous fistula following blunt trauma treated with NPWT.

II. CASE REPORT

A 23-year-old male was admitted to the Local Emergency Department after a traffic accident. He was operated on urgently due to his hemodynamically unstable condition. Rupture of the liver with severe bleeding to the peritoneal cavity associated with bile duct injury and two perforations of the transverse colon were revealed. Immediately, perihepatic packing to control the hemorrhage was provided. Transverse colon perforations were sutured in two places. Due to the laceration of the common hepatic duct, hepaticojejunostomy Roux-en-Y procedure was performed. The postoperative period was complicated with intractable bile leakage. The patient underwent three further laparotomies. Because of his deteriorating condition and increased bile drainage he was transferred to the referral hospital. On admission his general condition was poor (Fig.1).

Signs of sepsis and biliary peritonitis were present. The patient was operated on within 24-h after admission to the hos-
A significant biliary peritonitis due to anastomotic dehiscence was revealed. Following exploration of hepaticojejunostomy, re-anastomosis was performed. In some places, small and large bowel perforations were closed and loop ileostomy was created (Fig. 2). Four days following re-laparotomy, bile discharge was noticed in the drain located in the perihpatic lodge and intestinal contents evacuating through the abdominal wound was observed due to two enterocutaneous fistulas. Because of persisting abdominal wound dehiscence with two high output enterocutaneous fistulas and biliary- cutaneous fistula, general poor condition and intense intraabdominal inflammation, NPWT was implemented as a method of choice. Moreover, previous hepatico-jejunostomy Rous-en-Y procedure excluded any endoscopic management.

Fig.1  Abdominal wound on admission to hospital demonstrating dehiscence of the wound with skin maceration and irritation due to intestinal contents. Significant inflammatory and necrotic changes of the wound edges were observed.

Fig.2 Intraoperative view of the peritoneal cavity. Note the sutting of the enteric fistula (black arrow) and perihepatic bile collection (star).

A special abdominal set dressing was used. Non-adherent drape was cut to the appropriate size of the wound and applied over the exposed internal organs. Over that, a foam layer was placed to properly distribute the negative pressure over the entire wound. In the place over the highest output fistula, a hole in the foam layer was excised to facilitate evacuation of intestinal effluent. Finally, adhesive drapes were applied to maintain negative pressure. The drain was connected with a NPWT unit allowing constant drainage. Suction was set up in an intermittent cycle of pressure 125mm Hg in 5-minutes active sequence and 50 mm Hg in passive sequence lasting 2 minutes. Dressings were changed in the operating theatre every other day or as required. Because of the ribs arcs located close to the wound’s edge, presence of ileostomy and an extensively affected surface, stoma paste was used to ensure that the whole system was sealed. Initially, the size of the foam layer was directly adapted to the dimension of the wound. Due to progression of wound healing, the size of the applied foam layer was smaller in comparison to the wound size. Foam was secured with several single stitches at the edges of the wound causing passive contracture of the wound edges resulting in size reduction of the wound.

Since the beginning of therapy, approximately 1100 ml of bile and intestinal contents was collected daily. The wound gradually diminished in size. Irritation and maceration of the surrounding tissues had decreased. The wound started granulating. Moreover gradual recovery of the patient was observed. This allowed the patient to be extubated, although antimicrobial therapy and total parenteral nutrition (TPN) was continued. Moreover, TPN and continuous infusion of Somatostatin decreased bowel movement and gastrointestinal secretion. Thus, the reduction of ECF output was achieved. At the end of the first week of therapy, ileostomy started providing intestinal contents. Drains were removed from the peritoneal cavity. In the second week of NPWT still two active ECFs were present with diminished amount of output. Biliary- cutaneous fistula was located outside the wound (yellow arrow). Intensive granulation of the right site of the wound was present and the areas of drain insertions had healed (Fig.3).
Granulation of the right site of the wound allowed for the securing of the biliary-cutaneous fistula with a stoma bag (Fig. 4).

The low output enterocutaneous fistula was closed using single sutures placed on the visible edges of the fistula with excellent results. We observed decreasing amount of intestinal contents collected daily in the third week of therapy (Fig. 5).

The suction parameter settings of the NPWT were reduced. This promoted end ileostomy to provide intestinal contents. Metabolic parameters were improved. Spectacular closing of the bile cutaneous fistula took place 4 week after the application of NWPT therapy. Progression of wound healing was observed. One of the enterocutaneous was still active with edges of the mucosa showing tendency to act as a typical stoma and thus it was regarding. At four weeks the abdominal wound had almost completely healed with one ECF treated as a “second” stoma (Fig. 6).

Partial enteral nutrition was implemented. The patient was transferred back to the regional hospital for further treatment and rehabilitation. In the future, further reconstruction of the digestive tract is planned.

Progression of decreasing output of BCF and ECF and increasing contents of ileostomy using NPWT. Note that bile values begin on the 8th day of therapy. Previously the entire wound was secured with one NPWT dressing and biliary and intestinal content were both collected together.
Fig 6 Fourth week of NPWT. Biliary-cutaneous fistula healed (yellow arrow). Enterocutaneous fistula (black arrow) regarded as a "second" stoma. Granulation and epithelialization of the wound.

III. DISCUSSION

Management of biliary fistulas is challenging. Usually, it is associated with injuries to other organs, thus making treatment extremely difficult. There are well known techniques in biliary tract restoration following injuries [6]. Despite the established method of treatment, final results are still unsatisfactory with increased rates of complications [3]. An unsuccessful primary surgery reduces the possibility for a good outcome. Furthermore, some procedures carried out as a primary exclude others to be feasible [7]. Although endoscopic management is feasible with a high success rate, it is not possible to perform in patients with hepaticojejunal anastomosis [8]. Another widely used method is percutaneous transhepatic biliary drainage, especially if endoscopic management is impossible to carry out [9]. This procedure is connected with increased rates of complications, especially vascular and thereby is difficult to use in non-distended intrahepatic ducts. Some authors reported using cyanoacrylate, metallic coils covered stents and other materials applied percutaneously in varying types of biliary fistulas [10,11,12]. However, these procedures are safe and feasible to perform only if carried out by well experienced radiologists and/or endoscopists.

Extensive abdominal wounds complicated with multiple enterocutaneous fistulas and biliary-cutaneous fistulas are associated with high mortality rates, ranging between 5 – 20% [13,14]. The other aspect of the comprehensive treatment is to secure and heal the extensive wound. Constant leakage of intestine and/or bile contents along with their harmful impact on the surrounding tissue makes the securing of the wound extremely difficult to perform.

So far numerous techniques have been developed to treat the open abdomen with ECF, but none have been proven to be superior to others [15]. Despite some controversies connected with NPWT, this method plays an important role in the treatment of complicated and extensive abdominal wounds with ECFs.

Although, NPWT was primarily designed for the treatment of open fractures, respectable results following the utilization of NPWT allowed for this type of therapy to be widely accepted [16]. Moreover, due to the lack of efficient therapy in other complicated diseases, NPWT has also been adopted in other indications [17,18,19,20,21,22,23,24].

The use of NPWT in the open abdomen has been deliberated for years. The first reports of NPWT therapy in management of the open abdomen caused many objections. It seemed that application of NPWT in the open abdomen may accidentally affect exposed intestines and predispose to create spontaneous ECF [25]. Moreover, patients with confirmed ECF treated with NPWT were predisposed to form increased numbers of new fistulas [26]. The introduction of specially designed non-adhesive drape, placed directly over exposed intestine loops, markedly decreased the risk for the formation of new enteric fistulas [29]. An increasing number of publications have confirmed high efficacy of NPWT in the treatment of intestinal fistulas. Shaikh et al. proved that only 4% of patients with extensive abdominal wall defects treated with NPWT developed new fistulas [27]. Barker et al. in a 7-year analysis of open abdominal wounds treated with NPWT found this method highly effective, with only a 6% risk of intestinal fistula formation [28]. Heller et al. reported only two patients who developed intestinal fistulas treated with NPWT [30]. Many consecutive studies confirmed the efficacy of this method [31,32,33]. Lopez et al. showed evidence of safety and effectiveness in groups of children treated with NPWT, even with the presence of ECF [34]. One consideration should be made as a final point, NPWT also facilitates the care of the patient in general such as allowing the patient to be mobilized faster and to improve the patients comfort level.

IV. CONCLUSIONS

Summarizing all advantages and disadvantages, we find NPWT to be a very useful and safe method. In complicated cases with many fistulas including biliary-cutaneous fistulas, NPWT is usually considered as a last resort. Reports concerning complete healing following multiple fistulas are rare. In cases of multiple fistulas, treating them as one of the leading, allows to cure the rest, accompanied by intensive healing defect of the abdominal wall.

The use of NPWT reduced the local inflammation, thus enabling gradual improvement of the patients general condition. NPWT application generated favorable conditions for the easy outflow of bile and intestinal contents. Gradual granulation of the wound bed and shrinkage of its margins are an important element of the therapy. The intermittent suction pressure resulted in spontaneous closure of some fistulas in the mechanism of reverse pressure gradients. With a few high output fistulas, remained an active only one. In principle, it should be regarded as another stoma, with consideration for future surgery.

To our knowledge this is the first reported case of biliary fistula treated with NPWT. Conventional methods of treatment of BDI and its complications such as biliary fistulas should be considered as the method of choice. In complicated cases, with a large defect of the abdominal wall, accompanied by a number of high output fistulas (including biliary fistula) we find that this method could be an alternative for the standard treatment.

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References


