

Impact of Negative Pressure Systems on the Healing Rates of Post-Surgical Pancreatic Fistulas: A Retrospective Review

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Abstract: Pancreaticoduodenectomy (Whipple procedure) is associated with low perioperative mortality in high-volume centers; however, postoperative morbidity remains high, with postoperative pancreatic fistula (POPF) being one of the most significant complications. As defined by the International Study Group on Pancreatic Fistula, POPF is diagnosed when drain fluid collected on or after postoperative day three shows amylase levels greater than three times the upper limit of normal serum values, with clinically relevant cases (Grades B and C) often requiring therapeutic intervention and occasionally leading to severe outcomes. Despite advances in surgical and perioperative management, POPF continues to contribute to prolonged hospitalization and increased morbidity. Negative pressure systems have emerged as a potential adjunct in managing complex postoperative wounds by improving fluid evacuation and promoting tissue healing. This retrospective study evaluates the impact of negative pressure systems on the healing rates of post-surgical pancreatic fistulas and assesses their potential role in improving clinical outcomes.

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I. INTRODUCTION

Perioperative mortality has become rare event after Whipple procedure, occurring in less than 2% cases at high volume centres. Despite its prevalence, morbidity persists in about three quarters of instances. A pancreatic fistula ranks as the second frequent outcome post-Whipple surgery; delay in stomach emptiness precedes it at number one⁽¹⁾ The ISGPF defines pancreatic fistulas based on visible drainage volumes starting from postoperative day three, requiring an amylase concentration exceeding three standard deviations above local reference ranges at least once within this period. To qualify precisely as a POPF, it must have

clinical significance. As a result, the old term "grade A postoperative pancreatic fistula" is now called a "biochemical leak" because it doesn't really affect the patient's condition and isn't considered a true pancreatic fistula anymore. The grades B and C for postoperative pancreatic fistula are still used, but they have more strict definitions. Grade B means the patient needs a change in their care after surgery, such as leaving a drain in place for more than three weeks or moving it using endoscopic or percutaneous methods. Grade C refers to cases where the pancreatic fistula is serious enough to require another surgery or leads to failure of one or more organs and/or death caused by the fistula.⁽²⁾

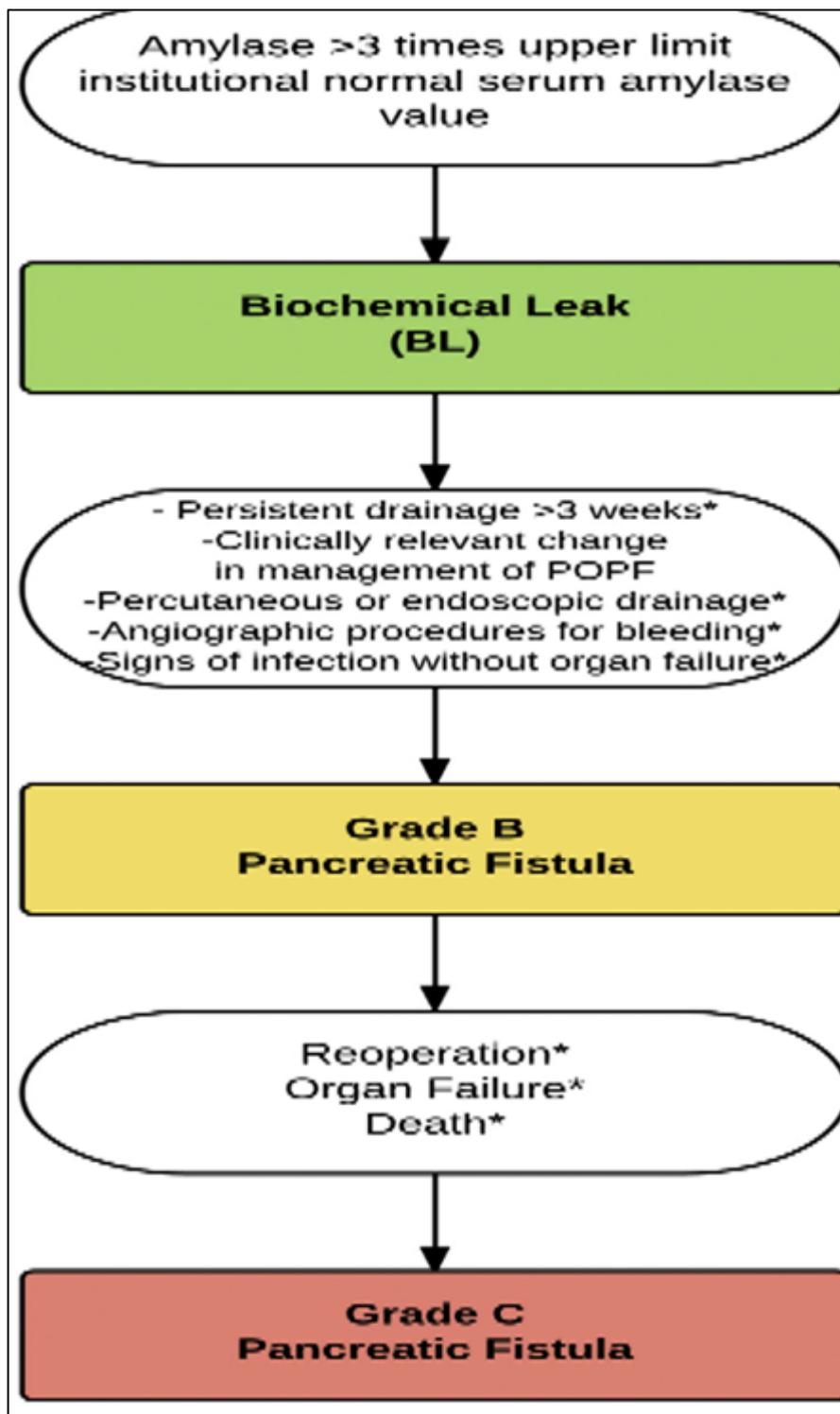


Fig 1 Treatment/ Event POPF Related

There are several studies reported preventive approaches for pancreatic fistulas including pancreatico gastrostomy vs pancreatico jejunostomy, pancreatic duct stenting, modified techniques in pancreatico jejunostomy, total pancreatectomy and prophylactic ocreotide⁽³⁾⁽⁴⁾. But no single study proven superior to other for preventing this devastating complication. Therefore we felt there is need of inventing novel techniques to manage pancreatic leaks rather than putting wast efforts on prevention. We found low pressure intermittent NPWT during initial days of

complication promotes faster healing, prevents sepsis there by enhances early recovery.

II. MATERIALS & METHODS

Retrospective data collected and analysed of patients who underwent whipples procedure between 2021 and 2025 followed by developed grade B postoperative pancreatic fistula i.e, evidence of raised amylase levels more than 3 times in drain collected from the wound leak along with the

systemic signs such as tachycardia, fever, tachypnoea and raised total leukocyte counts. The patients who had biochemical leak and severe grade pancreatic fistula i.e grade C including who underwent ICU care and had multi organ dysfunction were excluded from the study.

All of these patients of grade B postoperative pancreatic fistula underwent adequate debridement and saline irrigation under aseptic conditions followed by jelonet paraffin gauze application over the exposed wound to prevent adhesions to the polyurethane sponge. A sterile polyurethane sponge thereafter the application of jelonet was applied followed by which 16 F Ryles tube was fixed to the sponge using sutures. Another sponge was put over the Ryles tube and was fixed to the underlying sponge using sutures laterally which gives

sand-witch appearance (I.e, sponge-ryles tube-sponge) at the end. Finally one sterile adhesive cover (IOBAN or TEGADERM) was applied over the sand-witch with making sure of air tight seal. The Ryles tube other end was connected to the vaccum suction with low intermittent pressure (one hour application with the gap of every 1 to 2 hrs, with the pressure maintained between 80 to 100 mmHg). This negative pressure treatment was given up to 72 to 96 hrs or till the improvement of systemic signs and low output from the fistula. Once we achieved low output from the wound, treatment was stopped and rest of the wound managed by saline soaked dressings till complete healing of the fistula after which wound was approximated with secondary suturing.



Fig 2 Post-Operative Pancreatic Leak Developed on Day 4.



Fig 3 Application of NPWT Using Ryles



Fig 4 Completely Healed Wound during Follow Up



Fig 5 POPF Developed in Day 6



Fig 6 Wound After Application NPWT Using Conventional Method

III. STATISTICAL ANALYSIS

Retrospective data collected from the records 55 patients who underwent whipples procedure between 2021 to 2025 using a proforma and was tabulated in Microsoft Excel 2007 and total 9 patients were analyzed at the end using SPSS software version 23.0 for Windows. Categorical variables have been expressed as percentages. Continuous variables have been expressed as Mean \pm SD. Paired t-test has been used to compare outcomes within the group before and after application of NPWT in terms of wound size, output. Post-operative day of wound leak, duration of NPWT applied, number of days for complete fistula closure and the number of NPWT sessions required were assessed using Mean \pm standard deviation. A p value of <0.005 was considered as significant.

IV. RESULTS

Total 55 patients underwent pancreaticoduodenectomy (PD) for periampullary carcinoma at our hospital between 2021 and 2025. All the cases had undergone classical PD with pancreaticojejunostomy (PJ) and pancreaticogastrostomy (PG) anastomosis in 47 and 8 cases respectively. 3 patients died within a month of surgery (2 from sepsis following biliary leak and one from severe haemorrhage). Total 21 (38%) patients had pancreatic fistula after day 3 postop period. Nine patients had grade B pancreatic fistula who underwent NPWT therapy and Mean duration of intermittent NPWT application was 4 ± 2 days. Wound size and fistula output was significantly reduced after application of NPWT ($p < 0.05$). Mean number of VAC sessions required 2 ± 1 . Thereafter wound was managed using saline soaked gauze dressings. Complete fistula closure was achieved within Mean duration of 8 ± 4 days. Eleven patients had mild biochemical leaks which were managed conservatively and was discharged early. Rest 3 patients had severe leak in which 2 were re-explored and died consecutively within one month period.

V. DISCUSSION

As discussed previously in the introduction, though mortality rates were decreased after pancreaticoduodenectomy, morbidity was still high⁽¹⁾. Pancreatic fistula in terms of drain or wound leak amylase more than 3 times elevated of normal serum levels is the second most common and devastating complication after whipples procedure. According to International Study Group for Pancreatic Fistula (ISGPF) the postoperative pancreatic fistula (POPF) is 3 types based on severity⁽²⁾. Grade A leaks are considered as biochemical leak in which there is raised drain amylase levels more than 3 times without any wound dehiscence or leak or systemic symptoms. Grade B leaks are defined as persistent pancreatic fluid leak from the main wound or drain site with systemic signs including fever, tachycardia, tachypnoea, raised total leukocytes count. Grade C leaks are very severe in which patients will have features of multiorgan dysfunction and needs ICU care⁽²⁾.

Several studies reported including meta analysis of PG vs PJ and other methods such as pancreatic duct stenting, various technique of anastomosis to prevent postoperative pancreatic fistula and none proven superior to other⁽³⁾⁽⁵⁾⁽⁶⁾. There are very few studies mentioned about POPF management. Based on review literature majority of the biochemical leaks were usually self limiting and needs no intervention. Grade B fistula can be treated by good nutritional support, adhesive dressings to protect skin from leaking pancreatic secretions, somatostatin analogues such as octreotide or pasireotide in high output fistula, percutaneous drainage of abdominal collections if any and provided broad spectrum antibiotics. Indications for re-exploration includes grade C fistula with signs of peritonitis, bleeding, large intra abdominal collections with sepsis and failure of non operative management⁽⁷⁾⁽⁸⁾⁽⁹⁾.

NPWT represents a new approach gaining traction; it demonstrates efficacy across diverse scenarios including diabetes-related feet issues, surgical incision sites, exposed abdomens, and post-surgical hernia repairs. The mechanism of negative pressure wound therapy involves systematically

removing infected drainage directly from the injury site without causing irritation around it, thereby reducing bacteria levels and preventing infection. It retains hydration, augments oxygen flow near the injury site, accelerates new tissue formation, and speeds up recovery time.⁽¹⁰⁾

We experienced among the various aspects of the treatment in POPF, skin protection from leaking high output pancreatic juice is the most difficult task and frustrating. Inability to controlling fluid leak from the wound over the skin can ultimately leads to large surface area skin excoriation, bacteremia and sepsis. We tried various types of adhesive dressings to protect the skin but none proved its efficacy. NPWT is well known treatment for complicated wounds, but one of the known complication is enterocutaneous fistula. Studies reported persistent or non healing of fistula due to its negative pressure effect⁽¹²⁾. But all these studies are level 4 based evidence. Therefore we have modified the method of application in which we applied very low intermittent pressure not more than 100mmHg rather than using standard -125mmHg for only initial days of management till achieving low output controlled fistula⁽¹¹⁾. Thereafter rest wound was managed with normal saline soaked dressings, believing that long duration application of NPWT may leads to non healing or persistence of fistula. We have excluded biochemical leaks as most of them are self limiting not required NPWT. The reason behind excluding grade C fistula is assuming most of these patients needs re-exploration and ICU care.

All Nine patients who had grade B postoperative pancreatic fistula were effectively managed by initial low intermittent negative pressure therapy. None of these patients had any major complications except mild pain and signs of bleeding which were taken care of using analgesics and hemostatic methods. Results showed great improvement in counts, fever and systemic signs. Surrounding skin was completely protected which improved patients quality of life in terms of decreasing psychological burden and allowing greater patients mobility. Complete closure of fistula achieved within mean duration of 8 ± 4 days. The disadvantages of therapy which we observed was it is time consuming and needs expertise and frequent monitoring.

Retrospective nature with small sample size to show its effectiveness is one of the major limitation of our study. Lack of comparison with normal saline soaked dressings, lack information regarding cost are other limitations of this study.

VI. CONCLUSION

Effectiveness of Low Intermittent Pressure: Low intermittent negative pressure (-80 to -100 mmHg) applied to wound care in the initial days of the complication promoted faster healing and prevented sepsis.

Clinical Improvements: NPWT produced significant decreases in wound size and decreases in fistula output ($p < 0.05$). Additionally, it produced improvements in systemic signs of infection, such as fever and leukocyte counts.

Protection of Surrounding Skin: NPWT was effective in protecting surrounding skin from excoriation due to high-output pancreatic juice. This protection positively affected the patients' quality of life and mobility.

Fistula Closure: For these patients, complete closure of fistula occurred within an average of eight days (± 4 days), with a range of 3 to 17 days.

Avoidance of Complications: The authors used modified low pressure instead of standard high pressure (-125 mmHg) for NPWT to avoid the known risk of developing enterocutaneous fistulas due to prolonged use of NPWT.

➤ Study Limitations

There were several limitations noted by the authors that may limit the generalizability of these findings:

The study was a retrospective design and utilized a small sample size, (only nine patients with NPWT).

There was no direct comparison group that received care with traditional saline-soaked dressings.

This type of therapy is very labor intensive and requires specific training for both providers and patients along with frequent monitoring.

REFERENCES

- [1]. de Castro SMM, Busch ORC, van Gulik TM, Obertop H, Gouma DJ Incidence and management of pancreatic leakage after pancreatoduodenectomy. *British Journal of Surgery*. 2005 Sep;92(9):1117–23.
- [2]. Bassi C, Marchegiani G, Dervenis C, Sarr M, Abu Hilal M, Adham M, et al. The 2016 update of the International Study Group (ISGPS) definition and grading of postoperative pancreatic fistula: 11 Years After. *Surgery*. 2017 Mar;161(3):584–91.
- [3]. .Oneil Machado N. Pancreatic Fistula after Pancreatectomy: Definitions, Risk Factors, Preventive Measures, and Management—Review. *International Journal of Surgical Oncology*. 2012;2012:1–10.
- [4]. Lermite E, Sommacale D, Piardi T, Arnaud J-P, Sauvanet A, Dejong CHC, et al. Complications after pancreatic resection: Diagnosis, prevention and management. *Clinics and Research in Hepatology and Gastroenterology*. 2013 Jun;37(3):230–9.
- [5]. Keck T, Wellner UF, Bahra M, Klein F, Sick O, Niedergethmann M, et al. Pancreatogastrostomy Versus Pancreatojejunostomy for RECOstruction After PANcreatoduodenectomy (RECOPANC, DRKS 00000767): Perioperative and Long-term Results of a Multicenter Randomized Controlled Trial. *Annals of Surgery*. 2016 Mar;263(3):440–9.
- [6]. Menahem B, Guittet L, Mulliri A, Alves A, Lubrano J. Pancreatogastrostomy Is Superior to Pancreatojejunostomy for Prevention of Pancreatic Fistula After Pancreaticoduodenectomy: An Updated

- Meta-analysis of Randomized Controlled Trials. *Annals of Surgery*. 2015 May;261(5):882–7.
- [7]. Malleo G, Pulvirenti A, Marchegiani G, Butturini G, Salvia R, Bassi C. Diagnosis and management of postoperative pancreatic fistula. *Langenbeck's Archives of Surgery*. 2014 Oct;399(7):801–10.
- [8]. Smits FJ, van Santvoort HC, Besselink MG, Batenburg MCT, Slooff RAE, Boerma D, et al. Management of Severe Pancreatic Fistula After Pancreatoduodenectomy. *JAMA Surgery*. 2017 Jun 1;152(6):540.
- [9]. Allen PJ, Gönen M, Brennan MF, Bucknor AA, Robinson LM, Pappas MM, et al. Pasireotide for Postoperative Pancreatic Fistula. *New England Journal of Medicine*. 2014 May 22;370(21):2014–22.
- [10]. Subramonia S, Pankhurst S, Rowlands BJ, Lobo DN. Vacuum-Assisted Closure of Postoperative Abdominal Wounds: A Prospective Study. *World J Surg*. 2009;33(5):931–7.
- [11]. Bruhin A, Ferreira F, Chariker M, Smith J, Runkel N. Systematic review and evidence based recommendations for the use of Negative Pressure Wound Therapy in the open abdomen. *International Journal of Surgery*. 2014 Oct;12(10):1105–14.