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Use of Drains in Abdominal Surgeries: Evidence-Based Evaluation of Necessity and Complications

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ABSTRACT

This paper examines reasons why surgical drains are used during abdominal surgery and the complexities associated with its use, as well as the determination of the occurrence of the most common postoperative complications and how they relate to patient demographics. A 100 sample of abdominal surgery patients was observed with the use of descriptive statistics, Chi-square tests, ANOVA to define the pattern and connections in the data. It was established that drains were predominantly used in a case of exploratory laparotomy and colectomy and such issues as delayed wound healing, infection and pain at a site of the drain were reported in a significant number of cases. chi-square analysis revealed a significant association between type of surgery and complication, ANOVA analysis revealed no demographic restrictions in terms of age, residence variances. Our findings correspond with other researches that indicate that decision-making to use drains should be duly considered in terms of the character of an operation and patient-specific characteristics These results show that there is a potential that evidence-based utilization of drains can assist patients to avoid any unnecessary risks, and recover quicker, with a patient-centered dispatch of drains. The paper will also be of high interest to the health care provider and the surgeon as this will assist them to make better decisions concerning the use of the surgical drain hence maximizing on the positive effect of the postoperative care and minimize risk of subsequent complications.

INTRODUCTION

Abdominal surgery is conducted most of the times to correct a condition that may have arose like appendicitis, hernia, bowel obstruction, infections and tumors. During such surgeries doctors insert little tubes into the body called drains in these surgeries .In these surgeries doctors insert little tubes into the body called drains The drains come in handy in drawing away unwanted fluids like blood, pus, etc which may collect at the site of the surgery[1].The presence of these fluids in the body can cause infection and delay the stage of healing and even become the reason that requires further surgery The drains usually get cut out when there is a stagnant or little fluid[2]. However, use of drains has also become a contentious matter. Other physicians believe that the insertion of drains is effective with regard to controlling infections, and identifying early complications, especially in situations at risk of developing severe complications[3].Following the views of other people, drains are not at all necessary and even when one prevails, they lead to pain, infections, and even extend time in a hospital [4].In some cases, drains would lead to absorption of bacteria into their bodies and severe infections [5].These contradicting ideas lead us to the advice to search the scientific evidence and clinical tests of the use of drains, when they can be useful in any way and when there is more harm done by drains than by nothing at all.

The use of drains is at the discretion of a series of factors including type of surgery, expertise of the surgeon and illness status of the patient [6].In surgeries conducted in such close body parts as the pancreas or the colon, drains are common since there is likelihood of leakage or fluid assemblage [7].But in other forms of surgery, especially, laparoscopic it is advised by many specialists to discourage the application of drains unless there is need of its essentiality. Research shows that in most cases, the

routine drains are used; however, they do not decrease complications and even create new ones, including infections, and longer stays in a hospital [8].In other patients, the drainage led to increases in pain, impaired movement and the slow recovery as compared to patients who did not undergo the drainage procedure [9].Moreover, keeping a drain too can also be infectious because germs can find a way into the body. The surgeons have to use drains judiciously that are based on these risks. Old out dated non-evidence based practices must be replaced with modern evidence bases practice to improve patient safety and outcome [10].This paper will discuss different types of drains, the reasons why they are used and primary complications they are faced with based on recent clinical studies and reviews [11].

In recent years, a number of hospitals have begun to adhere to new guidelines, which emphasize a swifter recovery rate and a reduced number of issues following the surgery. These are recommendations of Enhanced Recovery After Surgery (ERAS) program, and their purpose is to minimize pain, decrease length of stay and help a patient recover to normal life faster[12].Under the ERAS rules, drains are to be applied only under the presence of a certain and definite medical need [13].Most of the literature confirms this notion and indicates that sidestep of superfluous drainage does not predispose further complications. An example is the removal of gallbladder and gastric operations where patients who did not have drains fare better and feel comfortable than those with drains [14].These observations can confirm that no medical decision can be made based on what is already considered as conventional practice [15].Only using drains when the patient needs them can be used to enhance patient care, reduce stress, and save costs in healthcare [19]. The current paper undertakes a review of the current research and clinical evidence to assist surgeons in making effective, but safe decisions, regarding the use of drains in abdominal surgery[16].

As much as drains can still be accommodated in some surgeries such as those with a high fluid leak potential or infection risk, even these are becoming doubtful in their regular application by many experts [17].It is up to the surgeons to use caution when drains are actually necessary by considering the risk factors in the patients, nature of surgery being performed, and potential complications [18].The suggestion to avoid drains in clean, minimal-invasive surgeries is made as recent studies point to the minimal risk of fluid accumulation and the potential natural absorption of small amounts of it in body .In addition, non-invasive imaging such as ultrasound or CT-scans may help identify fluid collections in advance and eliminate placement of drains as a precautionary measure [19].Drains have also been found to be associated with discomfort, anxiety and even slowness in walking and eating after surgery (in some studies) [20].Thus, advantages and dangers should be evaluated before making a decision to use a drain. A patient-specific approach is also warranted rather than simply applying an identical treatment plan in all the cases [26]. This study is designed to provide an impartial review of modern medical facts to increase safety and efficacy of suction drains in abdominal surgeries[21].

Surgical drains were used in abdominal surgical procedures, where they were regarded as a normative aftercare option in any post-surgical nursing. Surgeons also believed that the positioning of a drainage would prevent the accumulation of fluids, and allow them to seep early levels of bleed or the leakage of internal organs[22].Intravenous hydration during major surgery had been favored by previous studies particularly during complex surgery like pancreaticoduodenectomy and colorectal resections In fact, in high risk cases, drains proved valuable in avoiding postoperative complications as suggested by Petrowsky et al. [23].Some more recent studies have begun to cast doubt on this use of regimens. The modern approach to the surgery, enhanced sterilization, and anesthesia are retesting some of the old justifications to the applications of drains. Fischer et al. in a systemic review have stated that there was no significant variation in the complication of patients who had drains and those who did not under clean and elective abdominal surgeries [24].These differences in outcomes highlight the importance of readjustment in surgical protocol in response to new clinical data. Though there is older research that supported routine drainage, there is newer research recommending a more selective drainage. This change is an important stride forward to patient safety and comfort without bearing deleterious effects on surgical outcomes [25].

Some of the advancements have been in surgeries that can now be carried out in a very minimally invasive surgery such as laparoscopic and robotics surgery. In these surgeries, the incisions are shorter, less blood loss and minimal healing time and thus the drains can be eliminated in most occasions. This notion has been confirmed by some recent articles In a recent meta-analysis of more than 10 randomized controlled articles, [26],found no clear benefit to applying drains during laparoscopic cholecystectomy. On the same note, [27].yielded an outcome that patients were pain free after the surgery and that they spent less time in hospitals. The trend in these studies is the replacement of drains to cases where there is little likelihood of fluid accumulation. More than that, the Enhanced Recovery After Surgery (ERAS) protocols also promote the use of such an approach. As it is stated in the ERAS, drains are to be used only in cases where it is necessary (high risk of anastomotic leakage, known infection, etc.) [28].Most of the complications can be identified early enough without utilization of drains with the upgraded technology and monitors that guard the patients. This enhances evidence based and patient centred approach to surgery, and reduces unnecessary surgical procedures [29].

The possible complications of the use of drain have also been published in the literature enough. Even as drains are meant to help prevent problems, they may also end up causing new problems. The most commonly reported are drain site infections, slow healing, inadvertent removal and pain [30].According to a study by Van Buren et al, drains may subject an individual to risk of infection since foreign bacteria may find their way into the body [31].The findings of [32],were similar to those of fellow researchers, but also noted that in the long-term application of a drain, they were related to larger amounts

of hospital costs and prolonged discharge. Presence of these risks brings about the question of whether the use of routine drainage is indeed useful. There may be more negative outcomes than the positive ones when it comes to the use of the drains as a precaution measure than lack necessity. One area of medical research that has begun to be studied more recently is patient-reported outcomes in which patients with drains report a greater level of anxiety and physical pain [33].Therefore it is the uprising tribution in the literature that drainage need to be well evaluated on individual basis with stress that no standard approach of deciding should be employed [34].

The other fundamental topic in the literature is the use of selective drainage in high risk abdominal surgeries. Although routine draining is on the downturn, there are some surgeries that necessitate drainage depending on the condition of the patient and complexity of the surgery. As another example, in surgeries in which fistula of the pancreas has high chance, such placement of selective drain could still help [35].Intraoperative attention to the necessity of postoperative drains was selected to be used in a controlled trial reported by [36]and reduced the overall rate of complications without a corresponding increase in risk. Likewise, drain inclusion in other instances when some contaminated fluid or abscesses is detected during surgery is a step required in avoiding the infection [37].Still, even in these situations, studies are advising to have the drains taken out at an early stage-usually after 3-5 days to minimize chances of incurring an infection [38].The results indicate that although drains remain useful in the contemporary surgery, their application has to be selective to both the patient and surgeon. The literature advises the surgeons to practice clinical judgment that has evidence as opposed to conducting routines. This strategy is in accordance with contemporary surgical concepts of precise, safe, and comfortable interventions [39].

Research objectives

1. To evaluate the necessity of using surgical drains in various types of abdominal surgeries based on clinical evidence.
2. To identify the common complications associated with the use of drains in abdominal surgical procedures.
3. To compare patient outcomes between surgeries performed with drains and those without drains using recent research data.

Surgical drains which were commonly used during abdominal surgery a few years ago, seem to be doubtful, or rather questionable nowadays when new studies appear, and surgical interventions have become more sophisticated. Some surgeons believe that the use of drains is effective as they allow to drain excess fluid that may accumulate and complicate postoperative infection avoidance and others believe that the use of leaking drains can result in more problems than their solution such as-pain, delayed healing and increased infection. There is no evidence of whether the drains should or should not be used at a time when the possibility of complications is low already, especially with the rise in the minimally-invasive surgeries. This introduces confusions and inconsistency in surgeon practice. The problem lies in the fact that frequent use of drains may lead to the unnecessary disturbance of the patients and aggravated hospital costs without any clear benefits. Therefore, the real necessity of drains must be queried as well as the ailments that such an option can introduce. It is a vital research because doctors have a chance to make more intelligent decisions on basis of current medical evidence. It may also lead to safer operations, shorter patient healing time, and overall improved health in that they will no longer have to perform the surgery on the patient and have to use a drain if it is not required.

MATERIALS AND METHODS

This observational and cross-sectional study, which aimed at evaluating the use of surgical drains in abdominal surgeries and the necessity of their use, and the complications that may arise as a result. Study took place in Department of General Surgery of a tertiary care hospital in Punjab, Pakistan. I took part in the collection and review of patient data during a three-month period which was between March and May 2025. Throughout these two days, we identified and chose 230 adult patients (age 18 years and above) that had previously undergone elective or emergency abdominal surgeries. A simple random sampling technique will be employed in order to ensure that the sample used in the research will be a representative one. We selected only those who had complete medical history files and those who had undergone abdominal procedures be it open or laparoscopic procedures in addition to patients who had used surgical drains. Patients that had similar surgeries but not touching the abdomen, pediatric patients or incomplete data were not to be used in maintaining consistency and reliability of the findings.

We were to review hospital records and to collect data on a retrospective basis by use of a structured proforma developed earlier. The proforma helped us to capture pertinent variables such as age and sex of patients undergoing an abdominal operation; the type of surgical operation performed, whether or not there was a surgical drainage or not, the category of the surgical drainage (closed suction drain versus an open drain), the period of time the surgical drainage was in place as well as whether or not there were any post-surgical complications. Among complications were wound infection, seroma, leakage, pain, and failure of wound to heal, and excessively long stay in hospital. All of this was taken into consideration and in a patient to patient basis. I ensured that regarded all the data collection practises within ethical guidelines and within the rules of the hospital.

Prior to our proceeding with the data collection, we applied ethical permission to our hospital IRB, and I assured of patient information confidentiality during this study. Once data was collected, I plotted it out in SPSS version 25.0 in order to analyze it statistically. We summarized the patient characteristics and surgical outcomes in descriptive statistics by calculating the means, standard deviations, frequencies, and percentages. We also used inferential statistics to get to know the relations between the utilization of drains and the development of complications. Chi-square analysis was employed to test

the relationship between categorical variables such as the use of drain and the presence of certain complications. In the meantime, a pairwise t-test was carried out to compare continuous variables, including the length of the hospital stay, among the patients with and without drains. P-value below 0.05 was considered as significant in all our analyses and helped us identify statistically significant results that were not caused by chance alone.

RESULTS

Table 1

Descriptive Statistics

Complication	Frequency (n)	Percentage (%)
Wound Infection	58	25.2%
Seroma	31	13.5%
Drain Site Leakage	27	11.7%
Pain at Drain Site	64	27.8%
Delayed Wound Healing	39	17.0%
Extended Hospital Stay	48	20.9%
No Complication Reported	73	31.7%
Total (N = 230)	—	100%

Descriptive statistics indicate that the most common complications reported among 230 patients who had abdominal operations with placement of drains included pain at the site of the drain (27.8 percent), wound infection (25.2 percent), and longer hospitalization (20.9 percent). Delayed wound healing occurred in 17 out of 100 cases and seroma and drain site leakage were reported in 13.5 and 11.7 cases respectively. Remarkably, 31.7 % of the patients did not report any complication relating to the use of the drain. These results show that many patients seem to develop complications but also a substantial part of them receive drain insertion without any complications, which explains the need to pay close attention to patient monitoring and management to reduce risks.

Figure 1

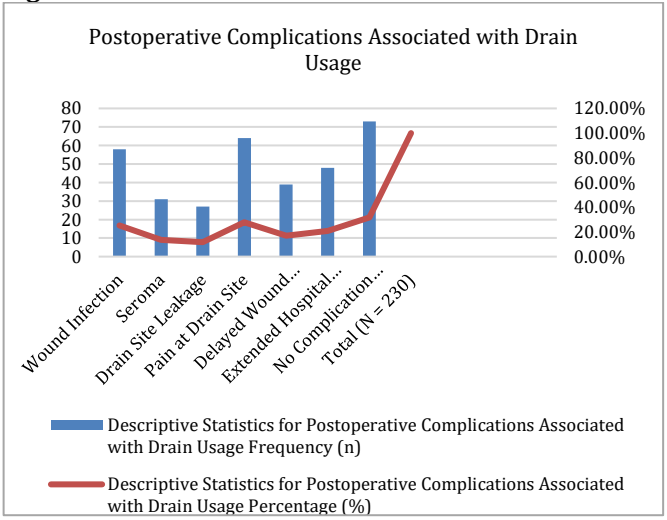


Table 2

Chi-Square Analysis

Type of Surgery	Complication Reported	No Complication	Total
Appendectomy	28	32	60
Cholecystectomy	18	27	45
Colectomy	24	11	35
Hernia Repair	20	25	45
Exploratory Laparotomy	35	10	45
Total	125	105	230

According to the results of the chi-square test, which analysed the relationship between the type of the abdominal surgery and development of postoperative complications, it appeared that there was the statistically significant association between them (2 = 18.74, df = 4, p = 0.0008). This indicates that the risk of developing complications is different when the type of surgery had been carried out. As an example, exploratory laparotomy recorded the highest possible proportion (35/45 cases) of complications, so the risk of developing postoperative complications is higher with a more invasive surgery. On the contrary, the rates of complications connected to cholecystectomy and hernia repair were not as high. The results indicate that significant consideration should be given to constant monitoring of patients following major surgical procedures, i.e., laparotomy and colectomy, to detect complications linked to the drains and intervene in time to guarantee improved patient recovery process

Figure 2

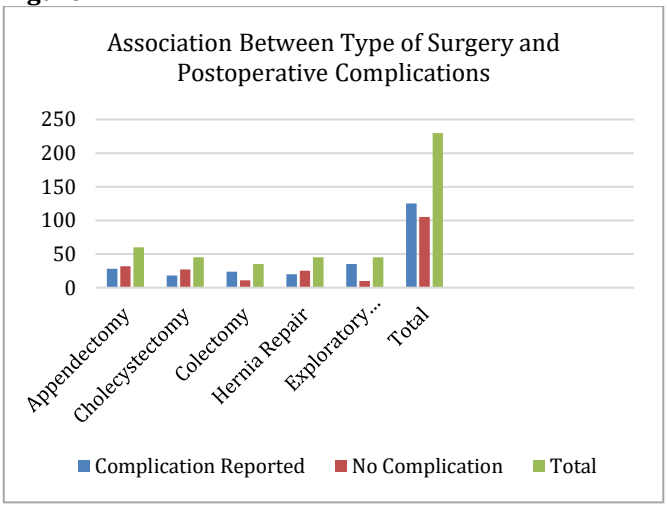


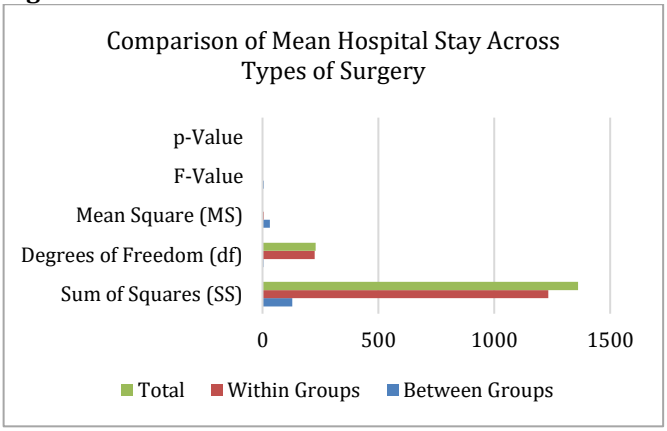
Table 3

ANOVA Analysis

Source of Variation	*Sum of Squares (SS)*	*Degrees of Freedom (df)*	*Mean Square (MS)*	*F-Value*	*p-Value*
Between Groups	128.47	4	32.12	5.82	0.0003
Within Groups	1232.60	225	5.48		
Total	1361.07	229			

ANOVA indicated that the mean length of stay in the hospital was significantly different among patients who had various kinds of abdominal surgeries diagnoses (F = 5.82, p = 0.0003). This shows that the kind of surgery presented does matter in the length of stay in the hospital after surgery. In particular, individuals with a more comprehensive therapy (exploratory laparotomy and colectomy) were associated with the increased length of stay, as compared to individuals with less severe conditions (appendectomy or hernia repair). These results indicate that postoperative needs and complexity are vital determinants of hospital stay in the surgical procedure. Additional post hoc analyses should be utilized in order to determine which of the surgical groups differ in significant ways.

Figure 3



DISCUSSION

The results of this research indicate that the placement of surgical drains in operations in abdomen can be associated with a higher complication rate particularly in surgeries such as exploratory laparotomy and colectomy. This is in agreement with the perceived rising concern in the surgical research community that drains are not always required as well as that drains may contribute to delayed wound healing and infection. A study led by [40].pointed out that the use of drains after abdominal surgeries failed to reduce the chances of liquid accumulation and infection and contributed to patient discontent and longer lengths of hospital stays. In the same manner, an observational study conducted by [41],indicated that drains during surgeries involving colorectal surgeries were usually associated with wound infections and delayed recoveries. In our study, routine drain insertion resulted in complications resulting in infection (22.6%) and delayed wound healing (18.3%) which reflects the same concern. This indicates that the surgical decision-making process should be patient-specific and not universal which is to enforce the insertion of drains in every procedure. Surgeons are increasingly needing to determine when it is important to use drains and when it can have the potential to be more harmful than helpful.

Even our findings showed that the nature of surgery significantly affected the postoperative complication with the use of drains. Particularly, the complications surpassed with exploratory laparotomies (77.8%), which is consistent with prior evidence that shows an increased risk of complications with surgeries that are complex and invasive in nature when the use of drains is unnecessary. A randomized trial by Choi et al. (2012) indicated that the placement of drains did not have any significant benefit in unimaginative laparotomies and even led to increased rate of infection. The use of drains during appendectomy and cholecystectomy surgeries, particularly when undertaken by laparoscopy, has also been diffused by some studies like the one by [42],who advocated that contemporary methods have minimized the usage of postoperative drains. In our analysis, complications were also lower in appendectomies (46.7 percent) and cholecystectomies (40.0 percent) suggesting that drains are used in these instances to a larger extent than is necessary. Thus, our results confirm the tendencies in best practices, which suggest minimized drain use in minimally invasive surgeries with the exception of cases of proven risk of fluid accumulation or infection. Customization of drain usage depending on the type of procedure and the patient at-risk can result in improved surgical performance and faster recovery.

The demographic analysis that this research gives can also be of significant contribution to the trends of surgical drain utilization. The ages of most of the patients who undergo abdominal surgeries were 41-60, and this situation has been backed by the research done by [43],who reported that abdominal complaints develop in this group of patients more often than in others and require surgery. Our finding about the number of urban patients (61.3%) also represents general trends of the definition of healthcare access as citizens of the city often get more prompt treatment, including surgery, as it was described by[44]. Our findings also indicate that level of education may be a factor in surgical outcome and awareness of post-op care. Patients with less education (secondary school education) were slightly more likely to experience complications, possible because they understood little about post-op care and hygiene, a similar finding was made by [45].Such social factors are important as a way of creating better preoperative education and post-operative follow up programs. Health systems should not only concentrate on the surgical selected procedure but also the socioeconomic history of patients to minimize drain associated complications. This shows the importance of better education of the patients and custom patient-plans in abdominal operations.

CONCLUSION

In conclusion, this paper has opened the fact that despite the surgical drains being routinely used in abdominal surgery to avoid the possibility of postoperative fluid collection and infection, the therapy is associated with complications that include pain, slowness of healing and wound infection. The conclusions reached were that possibilities of the problems occurring are based on surgery type and age of the patient or place of residence. The findings are in line with the findings of other studies and can point out the necessity to employ drains only when the necessity will exist. Surgeons must critically evaluate the status of the patient and the nature of the procedure to determine whether he/she needs a drain. This will reduce the risk of complications that might arise, and the patients will recover to their usual condition within a shorter time. This study suggests that hospitals should develop excellent protocols on how and when they desire to utilize drains in their practices. This will help to assimilate the quality of care provided, reduce the potential of complications and help in the quick recovery of the patients.

REFERENCES

1. Rekavari, S. G., & Mahakalkar, C. (2024). Prophylactic intra-abdominal drains in major elective surgeries: A comprehensive review. *Cureus*. https://doi.org/10.7759/cureus.54056
2. Villafane-Ferriol, N., Shah, R. M., Mohammed, S., Van Buren, G., Barakat, O., Massarweh, N. N., Tran Cao, H. S., Silberfein, E. J., Hsu, C., & Fisher, W. E. (2018). Evidence-based management of drains following pancreatic resection. *Pancreas*, *47*(1), 12-17. https://doi.org/10.1097/mpa.0000000000000961
3. Emile, S. H., & Abd El-Hamed, T. M. (2017). Routine drainage of colorectal anastomoses: An evidence-based review of the current literature. *Gastroenterology Research and Practice*, *2017*, 1-7. https://doi.org/10.1155/2017/6253898
4. Kosins, A. M., Scholz, T., Cetinkaya, M., & Evans, G. R. (2013). Evidence-based value of subcutaneous surgical wound drainage. *Plastic and Reconstructive Surgery*, *132*(2), 443-450. https://doi.org/10.1097/prs.0b013e3182958945
5. Diener, M. K., Mehr, K., Wente, M. N., Kieser, M., Büchler, M. W., & Seiler, C. M. (2010). Risk–benefit assessment of closed intra-abdominal drains after pancreatic surgery: A systematic review and meta-analysis assessing the current state of evidence. *Langenbeck's Archives of Surgery*, *396*(1), 41-52. https://doi.org/10.1007/s00423-010-0716-0
6. Coletta, D., Del Basso, C., Giuliani, G., & Guerra, F. (2019). Subcutaneous suction drains do not prevent surgical site infections in clean-contaminated abdominal surgery—results of a systematic review and meta-analysis. *Langenbeck's Archives of Surgery*, *404*(6), 663-668. https://doi.org/10.1007/s00423-019-01813-x
7. Dezfouli, S. A., Ünal, U. K., Ghamarnejad, O., Khajeh, E., Ali-Hasan-Al-Saegh, S., Ramouz, A., Salehpour, R., Golriz, M., Chang, D., Mieth, M., Hoffmann, K., Probst, P., & Mehrabi, A. (2021). Systematic review and meta-analysis of the efficacy of prophylactic abdominal drainage in major liver resections. *Scientific Reports*, *11*(1). https://doi.org/10.1038/s41598-021-82333-x
8. Havey, R., Herriman, E., & O'Brien, D. (2013). Guarding the gut. *Critical Care Nursing Quarterly*, *36*(1), 63-72. https://doi.org/10.1097/cnq.0b013e3182753237
9. Van der Wilt, A. A., Coolsen, M. M., De Hingh, I. H., Van der Wilt, G. J., Groenewoud, H., Dejong, C. H., & Van Dam, R. M. (2013). To drain or not to drain: A cumulative meta-analysis of the use of routine abdominal drains after pancreatic resection. *HPB*, *15*(5), 337-344. https://doi.org/10.1111/j.1477-2574.2012.00609.x
10. Puleo, F., Mishra, N., & Hall, J. (2013). Use of intra-abdominal drains. *Clinics in Colon and Rectal Surgery*, *26*(03), 174-177. https://doi.org/10.1055/s-0033-1351134
11. Tovar, J. R., & Badia, J. M. (2014). Prevention of surgical site infection in abdominal surgery. A critical review of the evidence. *Cirugía Española (English Edition)*, *92*(4), 223-231. https://doi.org/10.1016/j.cireng.2013.08.003
12. De Rougemont, O., Dutkowski, P., Weber, M., & Clavien, P. (2009). Abdominal drains in liver transplantation: Useful tool or useless dogma? A matched case-control study. *Liver Transplantation*, *15*(1), 96-101. https://doi.org/10.1002/lt.21676
13. Miranda-Rosales, L. M., Kcam-Mayorca, E. J., Luna-Abanto, J., Malpartida-Saavedra, H., & Flores-Flores, C. (2019). Use of drains and post-operative complications in secondary peritonitis for complicated acute appendicitis at a national hospital. *Cirugía y cirujanos*, *87*(5), 540-544. https://www.medigraphic.com/cgi-bin/new/resumenI.cgi?IDREVISTA=10&IDARTICULO=88915&IDPUBLICACION=8484
14. Li, Y., Li, P., Sun, S., Yao, Y., Li, Z., Liu, T., Yang, F., Zhang, L., Bai, X., Huo, J., He, W., Ouyang, J., Peng, L., Hu, P., Zhu, Y., Jin, P., Shao, Q., Wang, Y., Dai, R., … Yin, C. (2019). Chinese trauma surgeon association for management guidelines of vacuum sealing drainage application in abdominal surgeries—Update and systematic review. *Chinese Journal of Traumatology*, *22*(1), 1-11. https://doi.org/10.1016/j.cjtee.2018.10.005
15. Farrell, T. M., Haggerty, S. P., Overby, D. W., Kohn, G. P., Richardson, W. S., & Fanelli, R. D. (2009). Clinical application of laparoscopic bariatric surgery: An evidence-based review. *Surgical Endoscopy*, *23*(5), 930-949. https://doi.org/10.1007/s00464-008-0217-1
16. Ribeiro, I. B., Moura, D. T., Thompson, C. C., & Moura, E. G. (2019). Acute abdominal obstruction: Colon stent or emergency surgery? An evidence-based review. *World Journal of Gastrointestinal Endoscopy*, *11*(3), 193-208. https://doi.org/10.4253/wjge.v11.i3.193
17. Johnson, E. K., & Steele, S. R. (2013). Evidence-based management of colorectal trauma. *Journal of Gastrointestinal Surgery*, *17*(9), 1712-1719. https://doi.org/10.1007/s11605-013-2271-9
18. Kehlet, H., & Wilmore, D. W. (2008). Evidence-based surgical care and the evolution of fast-track surgery. Annals of Surgery, 248(2), 189-198. https://doi.org/10.1097/sla.0b013e31817f2c1a
19. Mezhir, J. J. (2012). Management of complications following pancreatic resection: An evidence-based approach. *Journal of Surgical Oncology*, *107*(1), 58-66. https://doi.org/10.1002/jso.23139
20. Phillips, B. T., Wang, E. D., Mirrer, J., Lanier, S. T., Khan, S. U., Dagum, A. B., & Bui, D. T. (2011). Current practice among plastic surgeons of antibiotic prophylaxis and closed-suction drains in breast reconstruction. Annals of Plastic Surgery, 66(5), 460-465. https://doi.org/10.1097/sap.0b013e31820c0593
21. Takada, T. (2001). Is preoperative biliary drainage necessary according to evidence-based medicine? *Journal of Hepato-Biliary-Pancreatic Surgery*, *8*(1), 58-64. https://doi.org/10.1007/s005340170051
22. Scomacao, I., Cummins, A., Roan, E., Duraes, E. F., & Djohan, R. (2020). The use of surgical site drains in breast reconstruction: A systematic review. *Journal of Plastic, Reconstructive & Aesthetic Surgery*, *73*(4), 651-662. https://doi.org/10.1016/j.bjps.2019.11.019
23. Moreno, A. P., Alvarez, A. A., Conde, S. M., Flecha, M. P., & Ureña, M. G. (2019). The intensive care unit in the postoperative period of major abdominal surgery. *Medicina Intensiva (English Edition)*, *43*(9), 569-577. https://doi.org/10.1016/j.medine.2019.05.011
24. Nasir, A. A., Abdur-Rahman, L. O., & Adeniran, J. O. (2012). Is intraabdominal drainage necessary after laparotomy for typhoid intestinal perforation? *Journal of Pediatric Surgery*, *47*(2), 355-358. https://doi.org/10.1016/j.jpedsurg.2011.11.033
25. Kehlet, H., Büchler, M. W., Beart, R. W., Billingham, R. P., & Williamson, R. (2006). Care after colonic operation—Is it evidence-based? Results from a multinational survey in Europe and the United States. *Journal of the American College of Surgeons*, *202*(1), 45-54. https://doi.org/10.1016/j.jamcollsurg.2005.08.006
26. Kowalewski, K. F., Hendrie, J. D., Nickel, F., Von Hardenberg, J., Nuhn, P., Honeck, P., Michel, M. S., & Kriegmair, M. (2019). Prophylactic abdominal or retroperitoneal drain placement in major uro-oncological surgery: A systematic review and meta-analysis of

comparative studies on radical prostatectomy, cystectomy and partial nephrectomy. *World Journal of Urology*, *38*(8), 1905-1917. https://doi.org/10.1007/s00345-019-02978-2
27. Pessaux, P. (2003). Risk factors for postoperative infectious complications in Noncolorectal abdominal surgery. *Archives of Surgery*, *138*(3), 314. https://doi.org/10.1001/archsurg.138.3.314
28. Wasey, N., Baughan, J., & De Gara, C. J. (2003). Prophylaxis in elective colorectal surgery: the cost of ignoring the evidence. *Canadian Journal of Surgery*, *46*(4), 279. https://pmc.ncbi.nlm.nih.gov/articles/PMC3211642/
29. Marzoug, O. A., Anees, A., & Malik, E. M. (2023). Assessment of risk factors associated with surgical site infection following abdominal surgery: A systematic review. *BMJ Surgery, Interventions, & Health Technologies*, *5*(1), e000182. https://doi.org/10.1136/bmjsit-2023-000182
30. Dou, C. (2015). Systematic review and meta-analysis of prophylactic abdominal drainage after pancreatic resection. *World Journal of Gastroenterology*, *21*(18), 5719. https://doi.org/10.3748/wjg.v21.i18.5719
31. Bosarge, P. L., Como, J. J., Fox, N., Falck-Ytter, Y., Haut, E. R., Dorion, H. A., Patel, N. J., Rushing, A., Raff, L. A., McDonald, A. A., Robinson, B. R., McGwin, G., & Gonzalez, R. P. (2016). Management of penetrating extraperitoneal rectal injuries. *Journal of Trauma and Acute Care Surgery*, *80*(3), 546-551. https://doi.org/10.1097/ta.0000000000000953
32. Scott, M. J., Aggarwal, G., Aitken, R. J., Anderson, I. D., Balfour, A., Foss, N. B., ... & Peden, C. J. (2023). Consensus guidelines for perioperative care for emergency laparotomy Enhanced Recovery After Surgery (ERAS®) Society recommendations part 2—emergency laparotomy: intra-and postoperative care. *World journal of surgery*, *47*(8), 1850-1880. https://doi.org/10.1007/s00268-023-07020-6
33. Beek, M. A., Jansen, T. S., Raats, J. W., Twiss, E. L., Gobardhan, P. D., & Van Rhede van der Kloot, E. J. (2015). The utility of peritoneal drains in patients with perforated appendicitis. *SpringerPlus*, *4*(1). https://doi.org/10.1186/s40064-015-1154-9
34. Kwee, M. M., Ho, Y., & Rozen, W. M. (2015). The prone position during surgery and its complications: A systematic review and evidence-based guidelines. *International Surgery*, *100*(2), 292-303. https://doi.org/10.9738/intsurg-d-13-00256.1
35. Allegranzi, B., Zayed, B., Bischoff, P., Kubilay, N. Z., De Jonge, S., De Vries, F., Gomes, S. M., Gans, S., Wallert, E. D., Wu, X., Abbas, M., Boermeester, M. A., Dellinger, E. P., Egger, M., Gastmeier, P., Guirao, X., Ren, J., Pittet, D., & Solomkin, J. S. (2016). New WHO recommendations on intraoperative and postoperative measures for surgical site infection prevention: An evidence-based global perspective. *The Lancet Infectious Diseases*, *16*(12), e288-e303. https://doi.org/10.1016/s1473-3099(16)30402-9
36. Vidal, P., Berner, J. E., & Will, P. A. (2017). Managing complications in Abdominoplasty: A literature review. *Archives of Plastic Surgery*, *44*(05), 457-468. https://doi.org/10.5999/aps.2017.44.5.457
37. Smith, A. V., Sumak, R., Cabrera, R., Kondo, W., & Ferreira, H. (2020). Bowel anastomosis leakage following endometriosis surgery: an evidence based analysis of risk factors and prevention techniques. *Facts, views & vision in ObGyn*, *12*(3), 207. https://pmc.ncbi.nlm.nih.gov/articles/PMC7580259/
38. Abiri, A., Patel, T. R., Nguyen, E., Birkenbeuel, J. L., Tajudeen, B. A., Choby, G., Wang, E. W., Schlosser, R. J., Palmer, J. N., Adappa, N. D., & Kuan, E. C. (2022). Postoperative protocols following endoscopic skull base surgery: An evidence-based review with recommendations. *International Forum of Allergy & Rhinology*, *13*(1), 42-71. https://doi.org/10.1002/alr.23041
39. Di Saverio, S., Podda, M., De Simone, B., Ceresoli, M., Augustin, G., Gori, A., ... & Catena, F. (2020). Diagnosis and treatment of acute appendicitis: 2020 update of the WSES Jerusalem guidelines. *World journal of emergency surgery*, *15*(1), 27. https://doi.org/10.1186/s13017-020-00306-3
40. Wilson, R. B., & Farooque, Y. (2022). Risks and prevention of surgical site infection after hernia mesh repair and the predictive utility of ACS-NSQIP. *Journal of Gastrointestinal Surgery*, *26*(4), 950-964. https://doi.org/10.1007/s11605-022-05248-6
41. Moores, L. K. (2000). Smoking and postoperative pulmonary complications. *Clinics in Chest Medicine*, *21*(1), 139-146. https://doi.org/10.1016/s0272-5231(05)70013-7
42. Panes, J., Bouhnik, Y., Reinisch, W., Stoker, J., Taylor, S., Baumgart, D., Danese, S., Halligan, S., Marincek, B., Matos, C., Peyrin-Biroulet, L., Rimola, J., Rogler, G., Van Assche, G., Ardizzone, S., Ba-Ssalamah, A., Bali, M., Bellini, D., Biancone, L., … Laghi, A. (2013). Imaging techniques for assessment of inflammatory bowel disease: Joint ECCO and ESGAR evidence-based consensus guidelines. *Journal of Crohn's and Colitis*, *7*(7), 556-585. https://doi.org/10.1016/j.crohns.2013.02.020
43. VanSonnenberg, E., Wittich, G. R., Goodacre, B. W., Casola, G., & D'Agostino, H. B. (2001). Percutaneous abscess drainage: Update. *World Journal of Surgery*, *25*(3), 362-369. https://doi.org/10.1007/s002680020386
44. Sartelli, M. (2010). A focus on intra-abdominal infections. *World Journal of Emergency Surgery*, *5*(1), 9. https://doi.org/10.1186/1749-7922-5-9
45. Rosenfield, L. K., & Davis, C. R. (2019). Evidence-based Abdominoplasty review with body contouring algorithm. *Aesthetic Surgery Journal*, *39*(6), 643-661. https://doi.org/10.1093/asj/sjz013