How to Cite:
Al – Rifai, M. T. M., & Murad, S. H. (2022). Long-term wound complication management after surgery: Clinical study. *International Journal of Health Sciences*, *6*(S9), 3745–3755.
https://doi.org/10.53730/ijhs.v6nS9.13452

Long-term wound complication management after surgery: Clinical study

Mansour Talip Mansour Al – Rifai
Department of Clinical Science, College of Nursing, University of Mosul, Iraq
Email: mnsourtalip93@gmail.com

Dr. Saad Hussein Murad
Department of Clinical Science, College of Nursing, University of Mosul, Iraq
Email: dr.saad.nursing@uomosul.edu.iq

***Abstract*---**Background: Chronic wound complication management post–surgical intervention has a significant strain on health-care systems, and require a lot of staff nurse specialists for management and complexity of services, as well as high treatment costs, making it extremely difficult to obtain health care for people with wounds complications which are a serious post-operative challenge, resulting in enormous expenses to the health care system burden. Methodology: (46) patient's were included from three teaching hospitals at Mosul City, study period from November 2021 to July 2022, data were gathered by using assessment sheet to collect demographic and a wound description data which include surgical wound characteristics, wound complication assessment, and intervention follow-up format. The (TIME) approach which include (tissue, infection, moisture, and edge) was used to give clear image about wound development healing and change induced by intervention protocol application. Results of the research involve (37) diagnosed cases of wound complication after surgery. (32.4%) of age group between 18-29 years of age, (64.9%) were males and (35.1%) were females. There were (62.2%) as clean wound, (67.6%) were as a major type of surgery, and (73%) for wound location in arm and leg, (67.6%) are major surgery while the majority of patients (78.4%) take (10-15 days). By compares the findings for three groups of post wound healing management (3 weeks, 4 weeks, and 6 weeks) based on development between the first and third observations for eachgroup in tissue development change, infection occurrence show minimize of pus infection production, moisture presence, and finally, edges of wound healing development all are shows a highly significant difference at (0.000) shows a highly significant difference (0.000). The need of application of strict wound management intervention through using wound management

guideline that benefit are goes beyond the wound healing and improve patient health comprehensively.

***Keywords*---**complication management, health-care, nursing.

1. Introduction

Chronic wounds are a global public health hazard that drains the healthcare system's resources. Chronic wounds have become a "hidden epidemic" in recent years. A wound's repercussions might include pain from the wound as well as the wound's social, physical, and psychosocial impact. When it comes to wound management, the correct approach should address how to reduce the financial burden while also lowering morbidity and mortality. Developing new preventative and therapeutic technologies will have a big impact, especially in low- and middle-income countries (LMICs), where healthcare is expensive and difficult to get (Gupta et al., 2021).

Patients with chronic wounds should be managed according to a holistic approach that includes a thorough medical history, testing that can detect infection in the wound bed, and identification of any presenting factors that may contribute to wound chronicity. Understanding the biological changes that take place in chronic wounds allows for the proper therapy to be prescribed, which may include traditional dressings or cutting-edge therapies like probiotics (Chamanga, 2018). Chronic wounds continue to present a difficulty in clinical practice and are associated with high expenditures, both in terms of the resources available to healthcare providers and the quality of life experienced by patients (Mailis & Lakha, 2019).

Patients who suffer from chronic wounds have significantly increased rates of morbidity and mortality. In addition, the treatment of chronic wounds is difficult, drawn-out, and involves a significant investment of time and money from both the patient and the healthcare system. Therefore, persistent wounds constitute a significant financial burden (Heyer et al., 2016). One of the most important clinical and financial challenges facing modern medicine is the problem of delayed wound healing. In addition, the healing of cutaneous wounds is an exceedingly well-controlled andintricate process (Schreml et al., 2010).

2. Materials and Methods

2.1 Location and participants

During the study period from November 2021 to July 2022. (46) patient's (males and females) were included from three teaching hospitals (AL– Jumhory, Al–Salam, and, and Al – Mosul General Teaching Hospitals) in AL-Mosul City, and the patient were chosen according to the following inclusions criteria: Patient admitted to the general surgical and other sub- specialty wards after surgical intervention who had non-healing wounds for more than 10 days post-surgery, non-pregnant woman, adult patients over the age of 18, and comorbid factors can lead to late healing processes. Exclusion Criteria: Patients suffering from

bed sores (Decubitus ulcers), diabetic foot, renal impairment, and venous and arterial insufficiency, children below 14 years old, and clean and non-infected wound.

2.2 Data collection and methods

At the beginning of conducting the study, the researcher obtains formal approval from the ethical committee of higher studies in Nursing College / University of Mosul (No.140, in 29/12/2021), and then get the hospital, and patient or their families member consent form to collect the study data. Data were gathered at the time of admission using assessment sheet to collect demographic and a wound description data which include surgical wound characteristics, wound complication assessment, and intervention follow-up format. The (TIME) approach which include (tissue, infection, moisture, and edge) was used to give clear image about wound development healing and change induced by intervention protocol application. The development of change and gradual healing of wound is based on the presence which equal (1) and absent which equal (2) that reflect the range of wound healing process.

2.3 Data analysis

Data were displayed as Mean ± Standard deviation and percentage. The P- value considered statistically significant at 0.05 or less. Data were entered into statistical package for social sciences "SPSS" version 26 and Excel 365 software for storage and statistical analysis.

3. Results

The study contains of 37 diagnosed cases of wound complication after surgery. Their mean age was 40.5 ± 15.93 with the highest rate (32.4%) of age group between 18-29 years of age, (64.9%) were males and (35.1%) were females (table 1). There were (62.2%) as clean wound, (67.6%) were as a major type of surgery, and (73%) for wound location in arm and leg (table 2).

Table (1): Distribution of patient sample according to their demographic characteristics

Variable	Group	Frequency	Percentage	$\bar{X}$	S.D.
Age	18-29	12	32.4%	40.05	15.93
	30-39	6	16.2%		
	40-49	8	21.6%		
	50-59	7	18.9%		
	60-69	3	8.1%		
	70-79	1	2.7%		
Gender	Male	24	64.9%	------	------
	Female	13	35.1%		
BMI	(< **18.5**) Under weight	1	2.7%	28.59	7.375
	(18.5 - 24.9) Normal	13	35.1%		
	(25-29.9) Over weight	8	21.6%		
	(≥30) Obese	15	40.5%		

Smoking	Non-smoker	21	56.8%	1.648	0.823
	X-smoker	8	21.6%		
	Currently smoker	8	21.6%		
Nutritional Status	Balanced diet	22	59.5%	1.405	0.497
	Un-Balanced diet	15	40.5%		
Mobility Status	Dependent	18	48.6%	1.513	0.506
	Independent	19	51.4%		

Note: *$\bar{X}$: mean; SD: standard deviation; BMI: body mass index,*

Table (1) shows that (32.4%) of the patient sample group were between the ages group of (18-29) years old, while (2.7%) of the ages group was between (70-79) years old. It also appears that (64.9%) of patient sample was male. Regarding to the Body Mass Index, the majority of (40.5%) patient sample found were)≤30(obese, while (2.7%) were (< 18.5) Underweight. Concerning the smoking habit, most of the patients (56.8%) are non-smokers. Furthermore, this table shows that (59.5%) of the sample is a balanced diet, while (40.5%) is as unbalanced diet according to nutritional status. Finally, this table shows that the majority (51.4%) was independent, while (48.6%) of the sample was dependent according to mobility status.

Table (2): Descriptive statistics for patient sample according to their general description for surgical wound characteristics

Variable	Group	Frequency	Percentage	$\bar{X}$	S. D
Wound type	Clean	23	62.2%	1.513	0.768
	Clean – contaminated	10	27%		
	Contaminated	3	8.1%		
	Dirty	1	2.7%		
Type of Surgery	Major	25	67.6%	1.324	0.474
	Minor	12	32.4%		
Duration of Wound post-Surgery	10-15 Days	29	78.4%	1.216	0.417
	16-20 Days	8	21.6%		
Surgical debridement	Yes	14	37.8%	1.621	0.491
	No	23	62.2%		
Allergy from dressing materials	Yes	9	24.3%	1.756	0.434
	No	28	75.7%		
Wound location	Head	1	2.7%	2.756	0.548
	Chest and Abdomen	8	21.6%		
	Arm and Leg	27	73%		
	Back	1	2.7%		
Pain Level	No pain	1	2.7%	2.378	0.545
	Mild	21	56.8%		
	Moderate	15	40.5%		
	Sever	0	0.0%		

Note: *$\bar{X}$: mean; SD: standard deviation.*

Table (2) shows general descriptions for surgical wound characteristics. It is clear that the type of wound shows that (62.2%) of the sample were clean wounds, while (27%) were clean-contaminated wounds. By reviewing the type of surgery, it is clear that a high percent was (67.6%) for major surgery. Concerning Duration of Wound Post-Surgery, the majority of patients (78.4%) take (10-15 days). Regarding surgical debridement, it is clear (62.2%) of the sample had no surgical debridement. dressing materials allergy records (75.7%) of patients had no reaction to the substance used. On the other hand, wound location according to area records a majority of (73%) for arm and leg causalities. Finally, the pain level showed that (56.8%) of patients had a mild level of pain.

Table (3):
Comparative statistics for wound assessment outcomes and follow-up post management intervention between (1st and 3rd) observation for (3 groups) according to length of wound healing

Parameter	categories	Three weeks		Four weeks		Six weeks	
		S. D	P 1st – 3rd observation	S. D	P 1st – 3rd observation	S. D	P 1st – 3rd observation
Tissue	Necrotic	0.363	0.000	1.557	0.000	0.500	0.011
	Sloughy						
	Granulation						
	Epithelization						
	Suture Wound						
	Sloughy and Granulation						
	Necrotic, Sloughy and Granulation						
	Suture and Granulation and Sloughy						
Infection	Healing-no signs of infection	0.425	0.000	0.597	0.000	0.500	0.011
	No healing						
	Infected						
Moisture	Exudate 0	2.277	0.000	1.818	0.000	1.707	0.013
	Exudate Aspect serous +						
	Exudate Aspect serous ++						
	Serous +++						
	Exudate Aspect Pus+ and odor						
	Pus ++ and Odor						
	Pus +++ and Odor						
	Normal						
	Maceration						

Edges	Dehydration	0.828	0.000	0.733	0.000	0.815	0.045
	Undermining						
	Thickened/rolled edge						
	Keratinized						
Peri-wound	Healthy skin	0.744	0.072	0.805	0.152	1.500	0.131
	Maceration						
	Excoriation						
	Dry skin						
	Hyperkeratosis						
	Callus						
	Eczema						

Note: *SD: standard deviation; +: amount of exudate; Sig.: significance at p. value=>0.05; 0: no exudate.*

This is the conclusion table (3), which compares the findings for three groups of post wound healing management (3 weeks, 4 weeks, and 6 weeks) based on development between the first and third observations for each group. The result of protocol guideline application by using (TIME) criteria shows a highly significant difference (0.000) with S.D value (0.363, 1.557, and 0.500) respectively for 3 groups for Tissue development change. By review another parameter of infection occurrence which revels a highly significant difference in the minimizing of pus infection production (0.000) with an S.D value (0.425, 0.597, and 0.500) respectively for 3 groups. In Moisture presence the result shows a highly significant differences (0.000) and S.D (2.277, 1.818, and 1.707) respectively for 3 groups. Finally, Edges of wound healing development shows a highly significant difference (0.000) with S.D (0.828, 0.733, and 0.815) respectively for 3 groups.

4. Discussion

4.1. Distribution of the patient sample according to demographic characteristics

Throughout the data analysis, the findings of the table (1) indicate that (37) patients in rolled and distributed to the age group, which ranged between (18 – 79) years old. In addition to that, the study finding reveals the mean and standard deviation to the age (40.05 ∓ 15.93), and the majority (32.4%) of sample was in age group between (18 – 29) years and the lowest value of (2.7%) of the sample between age group (70 – 79) years. These result of participant shows most of the patient are young, so this give suggestion that the are at risk group for trauma and accident in a various type. This finding is in congruent with (Kihla et al., 2014) which showed that more than more than (75%) of patients with chronic wound infection that their age group between (16 – 30) years. So, these findings were also consistent with a previous study by (Fentahun et al., 2021) that found a (55.8%) of total (310) patient age group between (18-40) years. In contrast of these result by study of (Yao et al., 2020) which finds that most of (1977) patient age group were between (60 years – and above) where 72.23% according to the population size , risk for infection and decrease of immunity and for surgery type.

The next result finding shows frequency and percentage according to gender variable, which indicate the majority of group are male patient were (n=24) (64.9%), while females patient record (n=13) (35.1%) with mean and standard deviation. these results are extremely reliable for studded group to the admission for male result by un-commitment of post- operative mobility restriction and care less of wound care.
These findings are in consentient with a study by (Gibb, 2016) which found that (80) patients (54%) of a total sample consisting of (146) patients were randomized to wound care were male patient according to admission are higher than female patient in controversial of these findings a result by (Salomé et al., 2015) found the proportion and ratio (70%) of female patients group were higher than male (30%) according to population statistics and type of gynecological surgery, which resulted in a high incidence of chronic wound infection.

By reviewing the result variable of body mass index (BMI) finding, it indicates there was a high percentage (40.5%) of obese according to value (7.30), so this finding may be due to many factors that are determined by a past history of medical problems such as DM, or cardiovascular disease with metabolic disorder. This finding is also supported by the study by (Thelwall et al., 2015) which reported that almost all patients with chronic wound infection post operation had obesity (79.8%) by fold (4.4) increase than other group, and this related to the disease process or chronic illness, and to lifestyle, or genetic variation of advanced age with gained weight. While the result of the study by (Manrique et al., 2017) mentions that the majority of the sample is normal or underweight (<18.5) (70%) with medical problems such as malnutrition, malabsorption, and psychological problem.

Ongoing to interpretation of result finding of patient variable, smoking cigarettes parameter of lifestyle, which finds most of the sample (56.8%) were nonsmokers with a mean and standard deviation (1.648 ∓ 0.823) while (21.6%, and 21.6) were x-smokers or smoking regularly, and this finding would be an important factor, especially for the development of wound healing and interfering with the result of progress management. These finding agree with a study by (Fu et al., 2018) which finds that most patient who undergo to surgical procedure and intervention with chronic wound infection are nonsmoker group ranged from (40.2% to 93.8%),and interfere with length stay shorter than smoker who remain long time period, while a study by (Lassig et al., 2017) disagree with the result findings which finds that majority of chronic wound infection in post- operative complication was (75%) of a total samples (28) patients were smoker who remine long time stay with a high mortality rate comparison with those nonsmoker.

According to nutritional status variable, the result had been indicated that high percentage (59.5%) who had balanced diet with mean and standard deviation (1.405 ∓ 0.497), this may be due to good nutrition habits that most sample follow up keep there health in balanced that presented in (BMI) parameter (normal, and slight overweight) (n=22) (56.7%). These findings come along with a study by (Herberger et al., 2020) which finds that most post-operative patients had a good nutritional balanced diet (62%) of total (90) patients, that contributed to the wound healing process and low-hospital length of stay time.

At last, the finding records a different value between mobility status parameter (n=18) (48.6%) and (n=19) (51.4%) for dependent and independent parameters, respectively, with mean and standard deviation (1.513 ∓ 0.506). From obvious findings, the interpretation can reveal that most cases had orthopedic surgery, which limited the mobility and made the patient dependently, while other types of surgical intervention didn't. On the other hand, pain in the surgical site and other areas had an effect on some dependently status. By reviewing the independent status, the age group between (18–19) which equals (32.4%) plays an important role in early mobility.

The result finding come compatible with the research out comes by (Finlayson et al., 2017) which found 50% of patients reporting severe restrictions in mobility post-operatively according to type of surgery and presence of chronic disease with restricted orthopedic fixation that interfere with mobility.

4.2. Descriptive statistics for patient sample according to their general description for surgical wound characteristics

Through the course of the present study, table (2) shows the general description of wound characteristics for patients with chronic wounds according to various parameters, which are presented as finding results by first assessment observation, which gives a direct clue of wound status as following: wound type, which shows a high proportion of (62.2%) for clean wounds and (27%) for clean contaminated with mean and S.D (1.513∓ 0.768). The finding is compatible with the explanation gained through the study, which revealed most post-operative wounds are clean in its nature and develop over time with malmanagement technique and the presence of other factors associated with medical history.

The results agree with a study by (De Vries et al., 2016) The review includes 19 articles summarizing 21 investigations (6 RCTs and 15 OCTs). Both randomized controlled trials and observational studies demonstrated a substantial benefit of NPWT over standard wound dressings in lowering SSIs, odds ratios of 0.56 (95% confidence range, 0.32–0.96; P = 0.04) and 0.30 (95% confidence interval, 0.22–0.42; P 0.00001). This reduces the SSI rate from 140 to 83 (49–135) and 106 to 34 (25–47) per 1000 patients. These findings were consistent across clean and clean-contaminated operations and types of surgery in stratified analysis. Orthopedic/trauma surgery findings weren't notable. GRADE-qualified evidence was low.

The next values related to the type of surgery that (67.6%) and (32.4%) for major and minor with mean and S.D (1.324 ∓ 0.474). This study shows the major types of surgery that have the highest value results for physical, pathological, and traumatic reasons that require in most cases admission to the operative theater. This result corresponds with the results of multi-center cohort study by (Bhangu et al., 2018) which found The Cholecystectomy (4412 [35%] of 12539 patients) and appendicectomy (4179 [33%]) were most prevalent. 6117 (48%) had emergency surgery, 5887 (46%) had open surgery, which belong to a major type of surgery.

By reviewing the duration of wound post-surgery un-healing or chronic wound, the results show (78.4%) and (21.6%) mean and S.D (1.216 ∓ 0.417) for (10-15) day and (16-20) day alternatives, which can be explained as mostly due to mis-use of appropriate dressing and unproper strict field for wound management of the wound. This finding is coincided with the results of research by (Tengberg et al., 2017) which show that the majority (64%) of complications within (15 – 30) days of emergency laparotomy surgery. However, it also found that (60%) of patients who had surgical site infection within 30 days post-surgery had high mortality rate. long time period for wound healing related to medical problems, steroid use, anemia, and mishandling of wound care.

Other parameters of surgical debridement that show (62.2%) has no early procedure with mean and S.D (1.621∓ 0.491) which work with the concept of most wound types doesn't have a procedure of debridement, result from lack of knowledge by staff nurse, which later is the core of care in wound management. This result is harmonize with study of (Pollak et al., 2010) that revealed (84) patients (27%) experienced an infection within the first two weeks following surgery. When the groups were examined in terms of the intervals between the injury and the first debridement, the interval between admission and the first debridement, there were no discernible differences between patients who developed an infection and those who did not. An independent predictor of the likelihood of infection was the interval between the post-surgery and infection occurrence.

The next parameter of allergy from dressing materials shows (75.7%) and (24.3%) alternatively for no and yes, with mean and S.D (1.756∓ 0.434) this result is by soft tissue and area of abdomen and face, and there was a small proportion of individuals who had sensitivity to iodine povidone. By review, wound location (73%) of the sample had arm and leg surgical procedures due to orthopedic surgery or even trauma that needed surgical intervention. Finally, pain level records at mild intensity (58.8%) and (40.5%) for moderate intensity which are caused by surgical site nerve damage and signs of infection, and pain caused by pre- and post-dressing changes or even with mobility.

4.3. Discussion of comparative statistics for wound assessment outcomes and follow-up post-management interventions between (1st and 3rd) observations for three groups according to the length of time of wound healing

The concluding table (3) show the result finding between (1st) observation on admission and (3rd) observation on discharge which demonstrate the development change of wound healing and highly significant different between two observation that indicate successful outcome of guideline protocol and the researcher intervention which adopted and implemented through the study period and absence of chronic wound infection parameter which casts a shadow to general health status and other aspect of psychosocial and financial domain. This interpretation for the integration among the (3) group concomitant with study by (Blackburn et al., 2019) that responses were generally positive, with a mean summed score of (28.3) of the assessment tool that focus of clinician check list in wound treatment which show improved assessment of tissue type

prompt identification of infection; prompt identification of exudate; improved identification of epithelization throw collection of data weekly after commencement treatment for three occasion (weeks). In other hand the response data to for (4 weeks) which show pattern change of the patient who transparent response from non- healing to healing with mean summed score from (28.6-28.2). Finally, last group wound healing show many respondents that change mean of assessment score over a time which indicate consistently positive response to the tool and management protocol which reflect the consistently of response to management.

5. Conclusions

Post-operative wound infection is widespread in surgical hospital in Mosul city, variation in wound healing time due to the presence of obstacles such as pus, as well as the presence of sloughy and necrotic tissue that contribute to wound management being prolonged rather than other wounds, there is a lack of an effective scientific program application in nursing staff duty to ensure best healing within a specified time frame and the development of wounds to chronic.

6. References

Gupta, S., Sagar, S., Maheshwari, G., Kisaka, T., & Tripathi, S. (2021). Chronic wounds: Magnitude, socioeconomic burden and consequences. *Wounds Asia*, *4*, 8-14.

Chamanga, E. T. (2018). Clinical management of non-healing wounds. *Nursing Standard*, *32*(29), 48-62.

Mailis, A., & Lakha, S. F. (2019). From (Ontario Ministry of Health and Long-Term Care) policy to implementation: a retrospective look at a community-based patient-centered model of care for chronic pain. Canadian Journal of Pain, 3(1), 114-125.

Heyer, K., Herberger, K., Protz, K., Glaeske, G., & Augustin, M. (2016). Epidemiology of chronic wounds in Germany: analysis of statutory health insurance data. Wound Repair and Regeneration, 24(2), 434-442.

Schreml, S., Szeimies, R. M., Prantl, L., Landthaler, M., & Babilas, P. (2010). Wound healing in the 21st century. J Am Acad Dermatol, 63(5), 866-881. https://doi.org/10.1016/j.jaad.2009.10.048

Kihla, A. J.-F. T., Ngunde, P. J., Mbianda, S. E., Nkwelang, G., & Ndip, R. N. (2014). Risk factors for wound infection in health care facilities in Buea, Cameroon: aerobic bacterial pathogens and antibiogram of isolates. *Pan African Medical Journal*, *18*(1).

Fentahun, N., Anteneh, Y., & Menber, Y. (2021). Malnutrition in the outcome of wound healing at public hospitals in Bahir Dar City, Northwest Ethiopia: a prospective cohort study. *Journal of Nutrition and Metabolism*, *2021*.

Yao, Z., Niu, J., & Cheng, B. (2020). Prevalence of chronic skin wounds and their risk factors in an inpatient hospital setting in Northern China. Advances in Skin & Wound Care, 33(9), 1-10.

Gibb, M. A. (2016). *Wound management nurse practitioner service: Parameters of practice and patient outcomes* Queensland University of Technology].

Salomé, G. M., de Almeida, S. A., & Ferreira, L. M. (2015). Association of sociodemographic factors with hope for cure, religiosity, and spirituality in patients with venous ulcers. *Advances in Skin & Wound Care*, *28*(2), 76-82.

Thelwall, S., Harrington, P., Sheridan, E., & Lamagni, T. (2015). Impact of obesity on the risk of wound infection following surgery: results from a nationwide prospective multicentre cohort study in England. *Clinical Microbiology and Infection*, *21*(11), 1008. e1001-1008. e1008.

Manrique, J., Chen, A. F., Gomez, M. M., Maltenfort, M. G., & Hozack, W. J. (2017). Surgical site infection and transfusion rates are higher in underweight total knee arthroplasty patients. *Arthroplasty today*, *3*(1), 57-60.

Fu, X.-L., Ding, H., Miao, W.-W., & Chen, H.-L. (2018). Association between cigarette smoking and diabetic foot healing: a systematic review and meta-analysis. *The international journal of lower extremity wounds*, *17*(4), 247-257.

Lassig, A. A. D., Joseph, A. M., Lindgren, B. R., & Yueh, B. (2017). Association of oral cavity and oropharyngeal cancer biomarkers in surgical drain fluid with patient outcomes. *JAMA Otolaryngology–Head & Neck Surgery*, *143*(7), 670-678.

Herberger, K., Müller, K., Protz, K., Zyriax, B. C., Augustin, M., & Hagenström, K. (2020). Nutritional status and quality of nutrition in chronic wound patients. *International wound journal*, *17*(5), 1246-1254.

Finlayson, K., Miaskowski, C., Alexander, K., Liu, W.-H., Aouizerat, B., Parker, C., Maresco-Pennisi, D., & Edwards, H. (2017). Distinct wound healing and quality-of-life outcomes in subgroups of patients with venous leg ulcers with different symptom cluster experiences. *Journal of pain and symptom management*, *53*(5), 871-879.

De Vries, F. E. E., Wallert, E. D., Solomkin, J. S., Allegranzi, B., Egger, M., Dellinger, E. P., & Boermeester, M. A. (2016). A systematic review and meta-analysis including GRADE qualification of the risk of surgical site infections after prophylactic negative pressure wound therapy compared with conventional dressings in clean and contaminated surgery. *Medicine (Baltimore)*, *95*(36), e4673. https://doi.org/10.1097/md.0000000000004673

Bhangu, A., Ademuyiwa, A. O., Aguilera, M. L., Alexander, P., Al-Saqqa, S. W., Borda-Luque, G., Costas-Chavarri, A., Drake, T. M., Ntirenganya, F., & Fitzgerald, J. E. (2018). Surgical site infection after gastrointestinal surgery in high-income, middle-income, and low-income countries: a prospective, international, multicentre cohort study. *The Lancet Infectious Diseases*, *18*(5), 516-525.

Tengberg, L., Cihoric, M., Foss, N., Bay-Nielsen, M., Gögenur, I., Henriksen, R., Jensen, T., Tolstrup, M. B., & Nielsen, L. (2017). Complications after emergency laparotomy beyond the immediate postoperative period–a retrospective, observational cohort study of 1139 patients. *Anaesthesia*, *72*(3), 309-316.

Pollak, A. N., Jones, A. L., Castillo, R. C., Bosse, M. J., & MacKenzie, E. J. (2010). The relationship between time to surgical debridement and incidence of infection after open high-energy lower extremity trauma. *J Bone Joint Surg Am*, *92*(1), 7-15. https://doi.org/10.2106/jbjs.H.00984

Blackburn, J., Ousey, K., & Stephenson, J. (2019a). Nurses' education, confidence, and competence in appropriate dressing choice. *Advances in Skin & Wound Care*, *32*(10), 470-476.