JURNAL KEPERAWATAN DAN FISIOTERAPI (JKF)
E-ISSN: 2655-0830
https://ejournal.medistra.ac.id/index.php/JKF

Evaluation of the Application of Infection Prevention Bundles in Reducing Infection Risk Factors in Total Thyroidectomy Patients at IBS RSP Hasanuddin University of Makassar: A Case Study

Tendri Mariadjeng Nurpa Masahude[1], Takdir Tahir[2*], Abdul Majid[2], Syahrul Ningrat[3]

[1]*Student of Nursing Program, Department of Nursing, Faculty of Nursing, Hasanuddin University, Indonesia, Perintis Kemerdekaan Km 10 Tamalanrea, Makassar 90245, Indonesia. takdirtahir@unhas.ac.id*
[2]*Department of Medical Surgical Nursing, Faculty of Nursing, Hasanuddin University*
[3]*Department of Emergency and Disaster Nursing, Faculty of Nursing, Hasanuddin University*

Abstract

Background: *Surgical area infections (IDOs) are a form of Healthcare Associated Infections (HAIs) that often occur, especially in complex surgical procedures such as total thyroidectomy, which has a high risk of infection due to the long duration of surgery and involvement of vital structures. Prevention of IDO can be done through the implementation of infection prevention bundles, including the administration of prophylactic antibiotics, pre and perioperative antiseptics, as well as blood temperature and glucose control. The purpose of the study is to evaluate the application of infection prevention bundles in reducing the risk of infection in patients undergoing total thyroidectomy with a diagnosis of bilateral thyroid cancer at the Central Surgical Installation of Hasanuddin University Hospital, Makassar.* ***Methods:*** *This study used a descriptive case study design with a single case design method using one sample, patients through three phases: pre-operative, intra-operative, and post-operative. The implementation of the infection prevention bundle includes the administration of prophylactic antibiotics, sterility techniques, blood sugar control, body temperature monitoring, and systematic wound care.* ***Results:*** *The total risk score of perioperative infection was 14 out of 30, indicating a moderate-high risk. However, the implementation of infection prevention bundles has proven to be effective in preventing infection. Evaluation of wound healing using the Southampton Wound Assessment Scale showed that the patient's wound was in a normal healing condition with no signs of infection until the fifth postoperative day. The patient was discharged on the fifth day with good general condition, normal swallowing function, and closed wounds without complications.* ***Conclusions and suggestions:*** *Consistent application infection prevention bundles can lower the risk of surgical area infection, accelerate wound healing, and shorten the duration of hospitalization. This study recommends the management of pre-operative risk factors such as hypertension control and patient education about postoperative wound care for sustainable healing.* of *This case study examines the application of infection risk factors in total thyroidectomy patients. The risk score for perioperative infection is 14 out of 30, which indicates a moderate-high risk. However the implementation infection prevention bundles has proven to be effective in preventing infection. The administration of prophylactic antibiotics, sterility techniques, blood sugar control, body temperature monitoring, and systematics wound care.*

Keywords**:** *Infection prevention bundle; Surgical site infection; Total thyroidectomy.*

1. INTRODUCTION

The operating room is a special unit in the hospital that is used to perform both elective and emergency surgical procedures. The operating room consists of 3 phases of service phases: preoperative, intra-operative, and postoperative. In the operating room environment, infection care and control are critical because surgical procedures have a high risk of exposure to various microorganisms that can cause infection. Applying sterility and using prioritized antiseptics can create a safe space for patients, reduce the risk of infection, and accelerate the healing process of surgical wounds [1]. *Healthcare-associated infections* (HAIs) occur in patients after treatment for more than 48 hours, and the patient is not in the incubation period [2]. One form of HAI is surgical area infection (IDO). The WHO's *2018 Global Guidelines for Preventing Surgical Site Infections* states that surgical site infections are part of nosocomial infections and one of the leading causes of high hospital HAI rates

Corresponding author: Takdir Tahir, Universitas Hasanuddin, Makassar, Indonesia
E-mail : takdirtahir@unhas.ac.id
Doi : 10.35451/jkf.v7i2.2583
Received : Februari 28, 2025, Accepted: April 19, 2025, Published: April 30, 2025

[3].The World Health Organization (WHO) states that IDO occurs in 2-5% of the 27 million patients operated on annually and constitutes 25% of all nosocomial infections.
Infection prevention in the surgical area can be done by implementing an infection prevention bundle (*bundle care IDO*). The surgical area infection prevention bundle includes prophylactic antibiotics, preoperative skin antiseptics, perioperative skin antiseptics, perioperative safety checklists, normothermia, supplemental oxygen, and glucose control [4]. According to *the Centers for Disease Control and Prevention (CDC),* this bundle can significantly reduce the infection rate [5].

In a total thyroidectomy procedure, the risk of infection increases because it involves the removal of thyroid glands adjacent to vital structures such as airways and large blood vessels. Therefore, implementing systematic preventive measures is essential to ensure patient safety. A systematic review showed several risk factors for surgical wound infection after thyroidectomy surgery, including total thyroidectomy, which is the duration of surgery more than 2 hours, comorbid disease such as diabetes or hypertension, over 50 years old, incision length more than 5 cm, and lymph node didsection [6]. A case-control study in Sweden involving 9.494 patients found that lymph node dissection and the use of postoperative drainage were independent risk factors for surgical wound infections after thyroidectomy [7]. In another study that used data from the American College of Surgeon National Surgical Quality Improvement Program (ACS-NSQIP) and found the incidence of surgical site infection after thyroidectomy was 0.36% [8].

In this case study, the researcher evaluated the application of infection prevention bundles in reducing infection risk factors in total thyroidectomy patients at the Central Surgical Installation, Hasanuddin University Hospital, Makassar.

2. METHOD

2.1 Sample
This descriptive case study uses *a single case design method* on Mrs M's preoperative, intraoperative, and postoperative patients.

2.2 Instrument
The data collection method in this case study was obtained by observing the implementation of infection prevention bundles in patients with total thyroidectomy. The instruments used in this study were the perioperative infection risk factor assessment sheet, the surgical area infection prevention bundle checklist, and *the Southampton Wound Assessment Scale (SWAS).*

2.3 Procedure
This study uses a descriptive case study with *a single case design* method on Mrs. M's preoperative, intra-operative, and postoperative patients. Descriptive research is a research method that aims to describe the situation objectively. The data collection method in this case study was obtained by observing the implementation of infection prevention bundles in patients with total thyroidectomy. This research has gone through ethical approval from the Faculty of Nursing number 070/523/SKP/SB/DPMPTSP/10/24. The instrument used in this study is a perioperative infection risk factor assessment sheet. According to research by Anwar et al, any score more than the cut-off point (11.5) will increase the risk of developing surgical area infection by 2.5 times, while a score of <11.5 has a lower risk of developing surgical area infection [9]. After that, an evaluation of the implementation of the infection prevention bundle was carried out using the infection prevention bundle checklist in the surgical area. Another instrument used is *the Southampton Wound Assessment Scale (SWAS)* [10]. SWAS is a scale used to systematically assess the healing condition of surgical wounds based on clinical signs and detect signs of infection. This instrument is used on patients on the first day after surgery and the 5th day of treatment. SWAS has 5 categories of wound healing classifications. The assessment was carried out by comparing the condition of the wound on the first and fifth days after surgery. The wound healing process is assessed by identifying signs of infection ranging from rubor (redness), calor (heat sensation), tumor (swelling), and dolor (pain). Then the categorization of wound healing was carried out.

3. RESULTS

Mrs. M, 65 years old, was admitted to the hospital on December 12, 2024, with a diagnosis of *bilateral Thyroid Carcinoma (suspected Adenocarcinoma Papiliferum)* with the main complaint being a lump on the neck that was getting enlarged and there was a seeping wound. The patient said the lump felt a stabbing pain with a pain scale of 2 NRS. The patient said a small lump appeared on the right side of the neck 2 years ago. History of surgery in 2023 in Sorowako. But 3 months after the surgery, the lump got bigger. Patients with a history of traditional medicine. History of hypertension with Amlodipine 10mg/24 hours/oral. Results of routine blood lab examinations (05/12/2024) Hb 9.4 g/ dL (anemia). Faal coagulation (PT 15.0, Aptt: 31.4, INR: 1.18 seconds). Thyroid function (FT4: 1.13 pmol/l, TSHS: 0.80 pmol/l: eutiroid effect). Photo of the thorax (05/12/2024), cardiomegaly with dilatation, elongation et, atherosclerosis aortae, no signs of metastases on the photo of the thorax. CT scan of the neck (22/10/2024) mass of hypodense regio colli anterolateral right malignant impression, multiple bilateral thyroid nodules. The results of the histopathology of Primaya Hospital 12/11/2024 with the suggestive focus conclusion of papiliferum adenocarcinoma with tumor metastases in the lymph nodes can be considered.

Table 1. Perioperative Risk Factors

Risk Factors	Scale	Points	Shoes
Risk Factors for Preoperative Infection			
Age	50-60 years and above	3	3
Smoke	Not a smoker	0	0
Weight	Obesity	2	2
Pre-Mediation :			
Corticosteroid	No	0	0
Prophylactic antibiotics	Yes	0	0
Operating area	Non-abdominal	0	0
Related diseases	Already	1	1
Laboratory examination results	Abnormal values	1	1
Length of treatment days	1 day	0	0
Shave	Immediately before surgery	0	0
Risk Factors for Intraoperative Infection			
Types of anesthesia	General/General	1	1
Classification of surgical wounds	Clean-Contaminated	1	1
Postoperative Risk Factors			
Body Temperature	Normal	0	0
Existence of drains	Closed	1	1
Drain removal day	Day 3 or more	2	2
Types of stitches	Detachable	0	0
Length of treatment days	3 days or more	2	2
	Total pre-operative score		7
	Total intra-operative score		2
	Total postoperative score		5
	Total risk factor score for perioperative infection		14

Table 2. Surgical Area Infection Prevention Bundle

Action	Done	
	Yes	**Not**
Pre operation		
Shaving	√	
Prophylactic antibiotics, 1 hour before surgery	√	
Body temperature	√	
Maintain normal blood sugar levels	√	
Intra-operative		
Limit the number of people entering the operating room	√	
Sterilization of operating room instruments	√	
Surgical gowns	√	
Wear a surgical mask to cover your mouth and nose thoroughly when	√	

entering the operating room	
Wear a headgear to cover your hair	√
For members of the surgical team who have washed their hands	√
Wear a sterile dress	√
Wear sterile gloves	√
Maintain aseptic techniques	√
Post operation	
Protect the wound that has been sutured with a sterile bandage for 24 to 48 hours postoperatively	√
Washing hands before and after surgical wound care	√
Wound care using aseptic techniques	√
Provide education to patients and families regarding proper wound care	√
Scheduling post-operative re-control	√

Based on Table 1, risk factors for perioperative infections were assessed, starting from preoperative, intraoperative, and postoperative. The perioperative risk factor assessment results resulted in a score of 14 out of a total score of 30. The surgery plan is to be carried out on December 12, 2024, with a Total Thyroidectomy with a surgical duration of 7 hours and 38 minutes.

In assessing risk factors for preoperative infection, a score of 7 out of a total score of 14 was obtained. In the preoperative stage, preparation for surgery is carried out by applying an infection prevention bundle. At the time of the study, the patient reported pain in the neck, which was caused by a lump that appeared 2 years ago. The pain was felt stabbing with a pain scale of 2 NRS. Patients are treated in the treatment room on the day the surgery schedule is determined to prepare for surgery. GDS monitoring was carried out with the results of the 132mg/dl GDS examination. Preparation for surgery with the administration of the prophylactic antibiotic cefazoline 1 gr/iv given 1 hour before the incision. Patients with the ASA PS Class 2 category. Shaving is not done in the treatment room but is done in the operating room. Some preoperative risk factors can be reduced by implementing infection prevention bundles. However, there are risk factors for patients, such as age factors and comorbidities.

In the intra-operative risk factor assessment, a 2 out of 4 score was obtained. Infection prevention bundles are applied in intraoperative settings. The surgical procedure that will be performed on the patient is a total thyroidectomy. General anesthesia is given to the patient, considering the surgical procedure and the length of the surgery. Before surgery, the surgical team washes their hands using surgical handwashing techniques, then uses *sterile gowns* and sterile handscoons with the proper methods. After that, the surgical area is disinfected circularly from the inside out using *chlorhexidine gluconate*. Then, dropping is carried out to establish a firm boundary for the surgical area in the *Colli region*. Then, to maintain the stability of the patient's temperature, an *air force warming (Bair-Hugger)* was administered. Meanwhile, the scrub nurse prepares surgical instruments using sterile techniques. Once the patient is ready at the operating table, the scrub nurse gives a time-out code. *Circular nurses* perfome a time out, verifying patient identity, diagnosis, and planned surgical procedure. Then, introduce team members (names and roles), DPJP, physician assistants, two anesthesiologists, one scrub nurse, one circular nurse, and students. After that, a collar incision is made according to the operation marker. The surgery lasted for ± 7 hours. Sign out and close the surgical area with stitches by leaving two drains, and then clean the wound using natrium clorida 0.9%. Followed by a primer dressing using suffrage and covered with sterile gauze.

A score of 5 out of 11 was obtained in the postoperative risk factor assessment. The patient was transferred to the ICU with an assessment of type 2 respiratory failure on a ventilator. An infusion is attached to the left hand (Ca. Gluconas line 100mg/24 hours/IV), and an injection in the right leg (ceftriaxone line 1 gram/12 hours). The application of the infection prevention bundle is carried out on postoperative patients, starting from monitoring the patient's body temperature and wound care as well as monitoring the characteristic signs of wounds and signs of infection. Wound care is carried out daily by cleaning the wound using Nacl 0.9%, then doing a primer dressing using suffrage and covering it with sterile gauze. Evaluate and monitor signs of infection using *the Southampton Wound Assessment Scale*, which is carried out on the first day postoperatively and the 5th day postoperatively.

Table 3. Wound Healing Classification, Southampton Wound Assessment Scale

Category (SWAS)	Classification	Date	
		13/12/24	17/12/24
0	Normal healing		√
I	Normal healing with a mild bruise or hematoma	√	
II	Erythema plus other signs of inflammation		
III	Clear or hemoserous fluid		
IV	Pus		
V	Deep or severe wound infection with or without tissue damage; hematomas that require aspiration		

Based on table 3 on December 13, 2024, the first day of surgery, showing client data with controlled pain but could not be identified because the patient was in an isolated state, the *Southampton Wound Assessment Scale*: I value with wound condition with a monitor for signs of infection heat (no heat sensation in the area where the surgery was performed), tumor (no swelling in the surgery area, rubor (redness in the surgery area). Meanwhile, on December 17, 2024, the 5th day of surgery, show client data saying pain in the surgical area, the *Southampton Wound Assessment Scale value* : 0 with wound conditions with a monitor for signs of infection heat (no heat sensation in the area where the surgery was performed), tumor (no swelling in the surgery area, rubor (no redness in the surgery area).

4. DISCUSSION

Total thyroidectomy is a surgical procedure to remove the entire thyroid gland. This procedure has become the standard of care for various conditions, such as thyroid cancer, multi-nodular goiter, and severe hyperthyroidism that is unresponsive to other treatments [11]. In this case, it was found that the results of the perioperative infection risk assessment, with a score of 14 out of a total score of 30, were carried out by implementing the infection prevention bundle in the surgical area. Implementing infection prevention bundles is a strategic approach that has proven effective in reducing the risk of infection, especially surgical area infection (IDO), one of the most common complications in surgical procedures. According to a study by Allegranzi implementing infection prevention bundles reduces the IDO rate by up to 40%. The interventions include antibiotic prophylaxis, preoperative skin preparation, and postoperative risk factor control [3].

Some factors that can increase the risk of infection, such as factors originating from the patient, include age, comorbidities, and obesity. Age was not a significant factor but was close to statistical significance, although the incidence of wound infections increased with age among the study samples. A greater likelihood of certain chronic conditions and decreased immunity with delayed wound healing, a factor usually associated with old age, can increase the risk of wound infections [9]. However, there are risk factors for infection that the implementation of infection prevention bundles can control to reduce the risk of infection in the surgical area, such as surgical factors and hospital environmental factors. In another study, comorbid diseases such as hypertension experienced for at least 6 month before surgery experienced higher levels of SSI. The role of hypertension in inducing infection through higher levels of intraoperative bleeding and poor soft tissue perfusion may be another reason [12]. BMI is believed to be an indicator or adiposity levels in a person's body and body fat measurement and weight category screening methods are easy to do. Fat has an important role in the structure and function of cell membranes. Essential fatty acids can't be synthesized by the body. Fatty acids play a role in the wound healing process. Patients who are overweight can increase the risk of infection in wounds because the blood supply of adipose tissue is inadequate. Obese patients have fatty tissue that is very susceptible to infection during the surgical phase, so they are prone to surgical wound infections because fatty tissue has poor vascularization and its effect on tissue oxygenation [13].

Implementing the infection prevention bundle includes three main phases: pre-, intra-operation, and post-operation. In the preoperative phase, the application of the surgical area infection bundle begins with the administration of prophylactic antibiotics, blood sugar control, body temperature monitoring, preoperative bathing, and shaving. In the preoperative phase, the infection prevention bundle is carried out on patients with total thyroidectomy, namely, giving prophylactic antibiotics. Using prophylactic antibiotics with the proper administration time of 30-60 minutes before the incision can reduce the risk of infection in the surgical wound [4]. Shaving the patient's surgical area is not done in the treatment room but is done shortly before the surgery begins. Shaving the surgical area can facilitate the surgical process, from marking the skin before surgery to stitching and wound closing. Shaving on the day of surgery shows a slight reduction in the risk of infection compared to shaving the day before surgery [14].

In the intraoperative phase, the infection prevention bundle carried out on Mrs. M's patient is the application of sterility techniques. Total thyroidectomy surgery with general anesthesia requires reasonable risk control of infection. The application of sterility techniques can reduce infection risk factors. Sterility techniques are carried out, from hand hygiene protocols to surgical procedures. Handwashing techniques either using a brush or without a brush, both have good effectiveness for sterility of the surgical team's hands in performing surgical procedures in the operating room [15]. All members of the surgical team must practice handwashing techniques using alcohol-based antiseptics before entering the operating room and performing surgery. Another study compared the effectiveness of 2.5% chlorhexidine-alcohol with 10% povidone-iodine in preventing SSIs in 100 patients who underwent clean-contaminated elective surgery. The results showed that the chlorhexidine-alcohol group had a significantly lower incidentce of SSI compared to the povidone-iodine group (5/12 cases; p=0.0084). this study supports the use of chlorhexidine-alcohol as a more effective preoperative skin antiseptic [16].

In the postoperative phase, the implementation of infection prevention bundles is carried out by monitoring body temperature and wound care as well as postoperative wound monitoring. During surgery, the body experiences metabolic stress that can increase the energy requirement to maintain normal physiological functions, including thermoregulation [17]. In addition, lengthy surgical procedures increase the risk of fluid loss through evaporation from the surgical wound surface and respiration, as well as through bleeding [18]. The body's metabolism will decrease during surgery which means the body will produce less heat thus increasing the patient's hypotermia and the decrease in core body temperature can be caused by impaired body temperature regulation due to the length of surgery and anesthesia [19]. Therefore, it is important to maintain a stable body temperature after surgery. Appropriate wound care interventions (e.g., appropriate bandage changes and proper wound irrigation) can speed up healing and reduce the risk of complications. The healing process of postoperative wounds should be monitored regularly to ensure that the wound does not experience complications, such as dehiscence (reopening) or decreased healing quality.

Based on the monitoring results until the 5th day postoperatively, the patient did not experience signs and symptoms of infection with a long day of treatment for 5 days. This is evidenced in research by Rahmawati, showing that patients with postoperative wound infections require a longer hospitalization [20]. In the study, patients with surgical wound infections were, on average, treated for about 7-10 days longer than patients who did not have wound infections. Wound infections cause a slowdown in healing and may require additional medical care, such as antibiotics and follow-up surgical procedures [12]. Surgical wound infections increase the length of stay and the cost of hospital care. Patients with wound infections require longer antibiotics, intensive wound care, and, in some cases, additional surgery to address complications, such as abscesses or dehiscence. This leads to longer treatment times and adds to significant hospital costs.

5. CONCLUSION

This study aims to evaluate the application of infection prevention bundles in reducing the risk of infection in patients undergoing total thyroidectomy diagnosed with bilateral thyroid cancer at the Central Surgical Installation of Hasanuddin University Hospital, Makassar. The results showed that the main factors contributing to the risk of infection included the patient's age, comorbidities such as hypertension, the duration of surgery reaching ±7 hours,

and the condition of the wound. The assessment showed a total perioperative infection risk score of 14 out of 30, indicating a moderate-high level of risk.

Implementing the infection prevention bundle is carried out systematically through three main phases: pre-operation, intra-operation, and post-operation. In the pre-operative phase, interventions include prophylactic antibiotics, blood sugar control, antiseptic baths, and shaving the surgical area shortly before the procedure begins. In the intra-operative phase, the procedures carried out include applying sterility techniques, using *chlorhexidine gluconate antiseptic* for disinfection, and monitoring the patient's body temperature using a heating device. Meanwhile, in the posto-perative phase, monitoring is carried out through routine wound care and monitoring for signs of infection using *the Southampton Wound Assessment Scale*, which shows the results of wound healing without signs of disease until the fifth day after surgery. Patients can be discharged on the fifth day with good general condition, normal swallowing function, and closed wounds without complications.

Based on these findings, the application of infection prevention bundles has proven effective in lowering the risk of surgical area infection (IDO), accelerating wound healing, and shortening the duration of patient hospitalization. To increase its effectiveness, it is recommended that infection prevention protocols be implemented consistently with risk management of comorbidities such as hypertension and anemia in the preoperative phase. In addition, patient education about wound care at home needs to be improved to ensure sustainable healing. Further research with a larger population is also necessary to evaluate the effectiveness and cost-efficiency of implementing this bundle. Multidisciplinary collaboration between surgeons, perioperative nurses, and infection teams must be strengthened to support the successful implementation of these protocols. This systematic approach is expected to become a standard practice for preventing infections and improving patient clinical outcomes.

ACKNOWLEDGMENTS

The researcher would like to thank the supervisor and the final scientific work examiner, who always helped and guided the research process.

REFERENCES

[1] I. Budiana and K. F. Nggarang, "Penerapan Teknik Aseptik Pada Asuhan Keperawatan Di Ruang Bedah RSUD Kabupaten Ende," *J. Keperawatan Terpadu (Integrated Nurs. Journal)*, vol. 1, no. 2, p. 56, 2019, doi: 10.32807/jkt.v1i2.38.

[2] Q. adar BakhshBaloch, "PMK RI Nomor 27 Tahun 2017 tentang Pedoman Pencegahan dan Pengendalian Infeksi di Fasilitas Pelayanan Kesehatan," vol. 11, no. 1, pp. 92–105, 2017.

[3] W. H. Organization, *Global guidelines on the prevention of surgical site infection*. 2018. [Online]. Available: http://www.who.int/gpsc/ssi-prevention-guidelines/en/#.WB6CWivkT70.mendeley

[4] I. Pudji Wahyuningsih, "Analisis Pelaksanaan Bundles Care Ido terhadap Kejadian Infeksi Daerah Operasi dan Dampaknya terhadap Lama Rawat Pasien," *J. Heal. Sains*, vol. 1, no. 6, pp. 366–376, 2020, doi: 10.46799/jhs.v1i6.66.

[5] CDC, "Surgical Site Infection Event (SSI) Introduction," *Natl. Healthc. Saf. Netw.*, no. January, pp. 1–39, 2022, [Online]. Available: https://www.cdc.gov/nhsn/pdfs/ps-analysis-resources/ImportingProcedureData.pdf.

[6] X. Huang *et al.*, "Risk factors for surgical site infection following pediatric spinal deformity surgery: a systematic review and meta-analysis," *Child's Nerv. Syst.*, vol. 13, pp. 2011–2022, 2024, doi: 10.1007/s00381-015-2659-9.

[7] F. A. Salem *et al.*, "A Nested Case–Control Study on the Risk of Surgical Site Infection After Thyroid Surgery," *World J. Surg.*, vol. 42, no. 8, pp. 2454–2461, 2018, doi: 10.1007/s00268-018-4492-2.

[8] D. M. Elfenbein, D. Schneider, H. Chen, and R. S. Sippel, "Surgical site infection after tyroidectomy: a rare but significant complication," vol. 190, no. 1, pp. 170–176, 2021, doi: 10.1007/978-981-16-4597-6_15.

[9] M. M. Anwar, A. E. Reizian, A. M. El Kholy, I. El Sayed, and M. K. Hafez, "An assessment scale for patients with postoperative superficial incisional surgical site infection: A cross-sectional study," *Indian J. Surg.*, vol. 80, no. 3, pp. 259–268, 2018, doi: 10.1007/s12262-016-1566-y.

[10] U. R. I. Febrianti, M. Agustina, M. Merry, S. Suhariyanto, and L. Andriyani, "Penggunaan Transparent Film Dressing Untuk Pencegahan Infeksi Luka Post Operasi Sectio Caesarea Pada Ny. I Di Rsud Dr. Rubini Mempawah," *J. Keperawatan Muhammadiyah Bengkulu*, vol. 12, no. 1, pp. 41–48, 2024, doi: 10.36085/jkmb.v12i1.5673.

[11] N. A. Binti Amir, Putu Dwyandaani Priyahita1, and Talitha Syahla1, Eva Triani, "Clinical Diagnosis and Management of Thyroid Cancer," *Unram Med. J.*, vol. 12, no. 3, pp. 240–246, 2023, doi: 10.29303/jku.v12i3.963.

[12] S. Saeedinia *et al.*, "The incidence and risk factors for surgical site infection after clean spinal operations: A prospective cohort study and review of the literature," *Surg. Neurol. Int.*, vol. 6, no. 1, 2015, doi: 10.4103/2152-7806.166194.

[13] N. N. Yudianti, "Jurnal Penelitian Perawat Profesional Pencegahan Tetanus," *Br. Med. J.*, vol. 2, no. 5474, pp. 1333–1336, 2020.

[14] J. Tanner and K. Melen, "Preoperative hair removal to reduce surgical site infection," *Cochrane Database Syst. Rev.*, vol. 2021, no. 8, pp. 1–113, 2021, doi: 10.1002/14651858.CD004122.pub5.

[15] P. P. Joy, "Perbandingan Cuci Tangan Bedah dengan dan Tanpa Sikat Terhadap Kesterilan Tangan Perawat Bedah di Instalasi Bedah Sentral RSUD Taman Husada Bontang," *J. Cakrawala Ilm.*, vol. 5, no. August 2006, pp. 228–235, 2016.

[16] B. John, R. K. K, and V. C, "Comparison of efficacy of chlorhexidine alcohol with povidone iodine for prevention of surgical site infection: a prospective study," *Int. Surg. J.*, vol. 5, no. 5, pp. 1668–1672, 2018.

[17] M. Okamura *et al.*, "Incidence of unintentional intraoperative hypothermia in pediatric scoliosis surgery and associated preoperative risk factors," *Spine Surg. Relat. Res.*, vol. 5, no. 3, pp. 154–159, 2021, doi: 10.22603/SSRR.2020-0170.

[18] Y. Hu, Y. Tian, M. Zhang, J. Zhao, and Q. Shu, "Study of risk factors for intraoperative hypothermia during pediatric burn surgery," *World J. Pediatr. Surg.*, vol. 4, no. 1, pp. 1–6, 2021, doi: 10.1136/wjps-2020-000141.

[19] E. T. Rahmanto, D. Novitasari, and W. Sukmawaningtyas, "Hubungan Lama Operasi dengan Hipotermi pada Pasien Pascaspinal Anestesi," *J. Penelit. Perawat Prof.*, vol. 6, pp. 1449–1458, 2024.

[20] T. Tahir *et al.*, "Topical Cream Derived From Hylocereus polyrhizus (Red Dragon Fruit) Extract Accelerates Wound Healing Through Increased Hydroxyproline and Fibroblast Growth Factor 2 Levels: A Pilot Study," *Plast. aesthetic Nurs.*, vol. 43, no. 4, pp. 210–216, 2023, doi: 10.1097/PSN.0000000000000526.