EFFECTIVENESS OF USING POST OPERATIVE DRAIN SUPPORT SYSTEM POST PAROTID AND THYROID SURGERY IN HOSPITAL UNIVERSITI SAINS MALAYSIA

BY

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Abstrak

Pendahuluan: Sistem saluran pembedahan adalah satu entiti yang membebankan pesakit. Ia boleh mendatangkan pelbagai masalah kepada pesakit termasuk saluran tiub terkeluar, tersirat, tergantung dan jangkitan kuman dan menyebabkan pesakit menjadi tidak selesa. Kajian ini di jalankan untuk mengkaji keberkesanan menggunakan sistem sokongan salur selepas pembedahan (Redivest, yang direka oleh staf wad Otorinolaringologi untuk memperbaiki penjagaan sistem saluran selepas pembedahan di wad. Satu proforma digunakan untuk mengkaji keberkesanannya.

Kaedah Kajian: Kajian ini dijalankan terhadap 39 pesakit yang menjalani pembedahan parotid dan tiroid. Pesakit dibahagikan kepada dua kumpulan dan satu kumpulan diberikan Redivest tersebut manakala kumpulan satu lagi menjadi kumpulan "kawalan" dimana saluran selepas pembedahan di biarkan seperti kaedah konvensional sedia kala. Pesakit kemudian diberikan satu proforma untuk di isi yang menggunakan soalan yang jawapannya 'ya atau 'tidak' dan kaedah "likert scale" sebagai jawapan untuk diisi. Data yang diperolehi dianalisa menggunakan SPSS versi 24.0.

Keputusan: Keputusan yang diperolehi daripada analisa menunjukkan rasa kesakitan dan keselesaan pesakit bertambah baik selepas menggunakan Redivest tersebut dengan purata median skor kesakitan 1.00 berbanding dengan kumpulan kawalan yang mendapat median skor 2. Berdasarkan analisa menggunakan Mann-Whitney U, "p-value" adalah signifikan dengan p-value < 0.001. Objective keselesaan pula bertambah baik dengan median skor 19.00 manakala median skor kumpulan kawalan adalah 9.50. Berdasarkan analisa menggunakan Mann-Whitney U, "p-value" adalah signifikan dengan p-value < 0.001.. Walaubagaimanapun, komplikasi tidak menunjukkan sebarang perubahan.

Kesimpulan: Dengan penggunaan Redivest ini, kita dapat menambah baik kesakitan dan keselesaan pesakit di wad yang mempunyai Redivest. Kadar komplikasi tidak menunjukkan sebarang perubahan.

Abstract

Background: Surgical drains can be very troublesome as they can pose problems in post-operative patients. This study was done to determine the effectiveness of Redivest to facilitate drain care in post-operative patients.

Objectives: To assess the effectiveness of using the Redivest in reducing the pain score at the drain site, increasing comfort level and reducing complication of having a drain post parotid and thyroid surgery

Methods: This is an interventional study, conducted on 39 patients, who underwent parotid and thyroid surgery and had drains inserted in Hospital Universiti Sains Malaysia from July 2016 to July 2017 involving 39 patients who were randomized into 2 groups with the post-operative drain support system termed as "Redivest", and the other was the control group where drains were anchored via the conventional method. Patients were given a questionnaire, which comprises of a yes or no answer and Likert scale best suited to their impression to answer during the hospital stay.

Results: 39 patients participated in this study aged from 18 to 80 from the Malaysian community comprising of the Malay and non-Malay ethnic group. Results showed difference in pain score observed between the two groups. The median pain score in in Redivest group was pain score of 1 while the median pain score on the control group was 2. Based on the Mann-Whitney U Test, the p-value is significant p-value < 0.001. The median comfort score in Redivest group was 19.00 while the median comfort score on the control group was 9.50. Based on the Mann-Whitney U Test, the p-value < 0.001 is significant. There were no complications seen in the Redivest group and the control group therefore could not be analyzed.

Conclusion: Usage of Redivest significantly improves the comfort and pain at the drain site, however the reduction in infections were insignificant.

Chapter 1

Introduction

1.1 Introduction

Surgical drain is a mechanism used in the medical fraternity to remove unusual buildup of fluid in a wound. The operating surgeon usually places them, or placed by an interventional radiologist to drain fluid in the newly formed wound.

Surgical drains have its complications of being occluded or clogged, resulting in intra-wound fluid buildup, which become a good nidus for infection and cause other complications. Efforts are to be taken to care for drains and regularly assess the patency of drains when they are in use. The use of surgical drains has been practiced widely for best intentions, in different surgeries many years (1). With better medical advances, management of patients should improve and operating surgeons should practice based upon scientific principles (2).

The type of surgery and the expected amount of fluid buildup is usually the factor for the number of drainage tubes and receptacles, which varies from as few as one or more. Usage of drains in thyroid surgeries are diminishing in value as it has been showed no added benefits in most thyroid cases (3). However in certain centers including Hospital Universiti Sains Malaysia it is still routinely used.

Management of drains is outlined by the type, intention and site. A standard protocol for drain care may help the ward staff with proper care of surgical drain (4). Drains are useful to characterize the drainage fluid for example, in the event of bleeding and identification of anastomotic leakage early (5). Drainage material has to be monitored for the colour, amount, and consistency of drainage fluid (6). A sudden increase in the drainage volume with a change in colour such as to greenish discharge, infection needs to be ruled out which in-turn leading to sepsis if left untreated. It is important to note and report changes as such and also sudden stop in drainage or

leaking around the drain insertion site as it indicates malfunctioning drains. On another note, drains that are kept in situ for long predisposes to infection, hence early removal reduces the risk of complications from having prolonged drains such as infection and prolonged hospital stay (7, 8).

Based on literatures, the use of intra wound vacuum drains the first 24 hours after surgery decreases the rate of seroma formation and hematomas, but less dramatically (9). Continuous suction negative pressure drains serve as an excellent "atmospheric bandage" in subcutaneous surgical procedures while helping to expedite wound healing and impede complications secondary to tissue plane dissection (10).

Surgeries and drains applied decrease the comfort level of patients as it increases the pain level and post-operative drain has shown to increase hospital stay and morbidity to patients and patients without drains have shown to have shorter hospital stay and better patient mobility (11,12,). As a result, drain causes discomfort by prolonging the hospital stay and restricting mobility and further more may complicate nursing care.

Pain and discomfort increase patients' anxiety and health care providers providing care are suggested to improve measures to reduce pain and anxiety for maintaining of comfort (13). Post-operative drainage support devices have been used in mainly breast and abdominal surgeries with surgical drains. It has shown to secure drains post operatively and facilitate care of drains, its uses have also been advocated in other surgeries with post-operative drains (14, 15). However its uses has not been proven as compared to without drain support systems. Hence this study was conducted to assess the benefit of using in in thyroid and parotid surgeries

Chapter 2

OBJECTIVES OF THE STUDY

2.1 General objective

- To evaluate the effectiveness of using the post-operative drain support system (Redivest) for patients after thyroid and parotid surgery

2.2 Specific objectives

1. To compare the pain score among patients using the Redivest and without the Redivest
2. To compare the comfort level in post-operative patients with drain and with the Redivest
3. To compare the complications of drain such as dislodgement, blockage, and infection when using the Redivest

Chapter 3

MANUSCRIPT

Effectiveness of Post Operative Drain Support System in Post Parotid and Thyroid Surgery

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Effectiveness of Post Operative Drain Support System in Post Parotid and Thyroid Surgery

3.2 Abstract

Background: Surgical drains can be very troublesome as they can pose problems in post-operative patients. This study was done to determine the effectiveness of Redivest to facilitate drain care in post-operative patients.

Objectives: To assess the effectiveness of using the Redivest in reducing the pain score at the drain site, increasing comfort level and reducing complication of having a drain post parotid and thyroid surgery

Methods: This is an interventional study, conducted on 39 patients, who underwent parotid and thyroid surgery and had drains inserted in Hospital Universiti Sains Malaysia from July 2016 to July 2017. This study involves 39 patients who were randomized into 2 groups with the post-operative drain support system termed as "Redivest", and the other was the control group where drains were kept via the conventional method. Patients were given a questionnaire, which comprises of a yes or no answer and Likert scale best suited to their impression to answer during the hospital stay.

Results: 39 patients participated in this study aged from 18 to 80 from the Malaysian community comprising of the Malay and non-Malay ethnic group. Results showed difference in pain score observed between the two groups. The median pain score in in Redivest group was pain score of 1 while the median pain score on the control group was 2. Based on the Mann-Whitney U Test, the p-value is significant p-value < 0.001. The median comfort score in Redivest group was 19.00 while the median comfort score of the control group was 9.50. Based on the Mann-

Whitney U Test, the p-value < 0.001 is significant. There were no complications seen in the Redivest group and the control group therefore could not be analyzed.

Conclusion: Usage of Redivest significantly improves the comfort and pain at the drain site, however the reduction in infections were insignificant

Keywords

Drain; drain complication; drain organization; drain utilization; drain

3.3 Introduction

Surgical drain is a mechanism used in the medical fraternity to remove unusual buildup of fluid in a wound. The operating surgeon usually places them, or placed by an interventional radiologist to drain fluid in the newly formed wound.

Surgical drains have its complications of being occluded or clogged, resulting in intra-wound fluid buildup, which become a good nidus for infection and cause other complications. Efforts are to be taken to care for drains and regularly assess the patency of drains when they are in use. The use of surgical drains has been practiced widely for best intentions, in different surgeries many years (1). With better medical advances, management of patients should improve and operating surgeons should practice based upon scientific principles (2).

The type of surgery and the expected amount of fluid buildup is usually the factor for the number of drainage tubes and receptacles, which varies from as few as one or more. Usage of drains in thyroid surgeries are diminishing in value as it has been showed no added benefits in most thyroid cases (3). However in certain centers including Hospital Universiti Sains Malaysia it is still routinely used.

Management of drains is outlined by the type, intention and site. A standard protocol for drain care may help the ward staff with proper care of surgical drain (4). Drains are useful to characterize the drainage fluid for example, in the event of bleeding and identification of anastomotic leakage early (5). Drainage material has to be monitored for the colour, amount, and consistency of drainage fluid (6). A sudden increase in the drainage volume with a change in colour such as to greenish discharge, infection needs to be ruled out which in-turn leading to sepsis if left untreated. It is important to note and report changes as such and also sudden stop in drainage or

leaking around the drain insertion site as it indicates malfunctioning drains. On another note, drains that are kept in situ for a long period predisposes to infection, hence early removal reduces the risk of complications from having prolonged drains such as infection and prolonged hospital stay (7, 8).

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Surgeries and drains applied decrease the comfort level of patients as it increases the pain level and post-operative drain has shown to increase hospital stay and morbidity to patients and patients without drains have shown to have shorter hospital stay and better patient mobility (11,12). As a result, drain causes discomfort by prolonging the hospital stay and restricting mobility and further more may complicate nursing care.

Pain and discomfort increase patients' anxiety and health care providers providing care are suggested to improve measures to reduce pain and anxiety for maintaining of comfort (13). Post-operative drainage support devices have been used in mainly breast and abdominal surgeries with surgical drains. It has shown to secure drains post operatively and facilitate care of drains, its uses have also been advocated in other surgeries with post-operative drains (14, 15). However its uses has not been proven as compared to without drain support systems. Hence this study was conducted to assess the benefit of using in in thyroid and parotid surgeries

3.4 Methodology

This is a randomized control study done in Hospital Universiti Sains Malaysia. Subjects consisted of patients that underwent thyroid and parotid surgery. This study was conducted from July 2016 to July 2017 for a period of 12 months. All patients were recruited from three different wards 4 Timur Depan (4TD), 3 Utara (3U) and 2 Intan (2I) from Hospital Universiti Sains Malaysia.

Participants

Eligible subjects were patients who underwent thyroid and parotid surgery requiring post-operative drains being between the ages of 18 to 80 years old. Non eligible subjects were subjects without post-operative drains, and immune-compromised subjects. A total of 39 patients satisfied the eligibility criteria to form the test and control group for the study fulfilling the criteria for pilot study (16). The Test group had 21 patients that underwent parotid and thyroid surgery with drains and was given a post-operative drain support system called as Redivest to keep their drains, while the control group had 18 patients whom also underwent parotid and thyroid surgery with post-operative drains and drains were kept the conventional method practiced in the wards. The selected patients were assessed for the pain, comfort levels, complications and the drain related post-operative parameters based on the proforma. (Appendix 2).

The study protocol was reviewed and approved by the Human Research Ethics Committee (HREC) of USM (Study protocol code USM/JEPeM 16030147).

Instruments and procedure

Patients who have undergone parotid or thyroid surgeries were randomized into Redivest group and given the Redivest **(Tables and Figures),** while the control group drains were kept via the conventional method in the respective wards. Redivest is the alternative drain support mechanism which was developed by the staff of ward 4TD and used which was tested in our study. Each Redivest is reused after standard protocol sterilization method for hospital gowns in Hospital University Sains Malaysia.

This invention, the Redivest **(Tables and Figures)** is a post-surgical drain support system which help safe keep and maintain the drain position when one or more drain is used post surgically and can be used comfortably by the post-operative patients **(Image 1).** This invention is composed of an adjustable main belt to suit different patient sizes **(Image 2).** The pockets and straps receive the individual drain and the receptacles, which is typically a vacuumed plastic bottle **(Image 3**). These pockets are positioned at a point well below the drainage tube point of insertion to allow passive drainage when passive drain is used **(Image 4).**

A proforma was used to assess the the specific objectives. This proforma was developed and undervwent content and face validation for data collection. It was developed based on the routine drain anchoring mechanisms and the common problems associated with surgical drains in the ward. The proforma was in the form of a likert scale and a yes/no answer scheme to standardize the response **(Appendix 1).** The data collection was done by the principal investigator.

Definition

Pain was assessed using a likert scale ranging from one to ten. Comfort level was assessed also using likert scale ranging 1 to 5. The comfort levels was assessed based on the method of keeping the drainage bottles and if it was able to hold the drainage bottles and tubes adequately for example during ambulation. In addition to that, the patients were asked if they were comfortable with the method of drain keeping provided to them. Patients were assessed if they would recommend this method of drain keeping to others. Assessment of drain complications, includes dislodged drains, blocked drain and infected drain site. Based on the objectives, the results obtained will be added together for the statistical calculation and analysis.

Sample characteristics

A convenience sampling of patients who underwent thyroid and parotid surgery during the time frame of 12 months was done and yielded a total of 39 patients from 3 different wards, 4 Timur depan, 3 Utara and 2 Intan from July 2016 to July 2017. These patients were then divided into control and test groups as per rule of thumb of sample size in pilot studies (16). Drains were inserted for patients undergoing thyroid and parotid surgeries in the study and number of drains depend on type of surgery with hemithyroid 1 drain, superficial and total parotidectomy 1 drain, and subtotal and total thyroidectomy 2 drains respectively.

The mean age distribution of the Redivest group was 53.8 years while the control group was lower 44.3 years. Both groups had equal distribution of Malay patients of 16 in the Redivest group and17 in the control group while the non malay group had 5 patients in the redivest group and 1 in the control group. For the type of surgery, Redivest group had 14 and control had 17

thyroid patient while while Redivest group had 7 and control group had 1 parotid patients. The number of drain in both groups had a mean of 1.57 and 1.50 in redivest and control group respectively while the hospital stay was 5.43 days and 5.83 days respectively. This demographic distribution is tabulated accordingly in **(Table 1).**

Statistical analysis

Data analysis is performed with IBM SPSS software version 24.0. For specific objective one and two, Mann Whitney U Test was used for statistical analysis. Meanwhile, for specific objective 3, chi-square was used for statistical analysis. A significant p-value was less the 0.05.

Results

This study involved 39 patients who were scheduled for thyroid and parotid surgeries ages 18 to 80. We had total of 10 hemithyroid patients, 20 total thyroid patients, 1 subtotal thyroid patient and 7 superficial parotidectomy patients and 1 total parotidectomy patient. Depending on the surgery, the number of drains varies with hemithyroid and parotid surgeries having 1 drain each and subtotal and total thyroid having 2 drains each. The control group had 18 patients with 9 patients having 2 drains and 9 patients with 1 drain where else the Redivest group had 21 patients and 12 patients with 2 drains and 9 patients with 1 drain. Descriptive data table shows the demographic distribution of the data obtained from the sample analyzed **(Table 1).**

The sum of ranks for pain score of drain site post-surgery with a vest is 300.5, while the sum of ranks for pain score without a vest is 479.50 **(Table 4).** The median pain score in in Redivest group was pain score of 1 while the median pain score on the control group was 2. Based on the Mann-Whitney U Test, the p-value is less than 0.001. Since the p-value is less than 0.001, based on ranking, there is a significant difference in pain score of drain site post-operatively between using a vest and without the redivest. **(Table 2).**

The sum of ranks for comfort level of patient post-operatively with Redivest post surgery is 609.0, while the sum of ranks for comfort level of patients post surgery without a vest is 171.00. **(Table 4).** The median comfort score in in Redivest group was 19.00 while the median pain score on the control group was 9.50. Based on the Mann-Whitney U Test, the p-value is less than 0.001. Since the p-value is less than 0.001, based on ranking, there is a significant difference in comfort score of drain site post-surgery between using a vest and without the redivest. **(Table 3)**

There were no complications seen in the Redivest group and the control group therefore could not be analyzed.

Discussion

The head and neck region is a very vascular region, with rich vascular network which are prone to bleeding and hematoma formation when an injury occurs. Surgery in other areas such as limbs utilizes methods of hemostasis such as tourniquet application to reduce bleeding intra-operatively as compared to head and neck surgeries (17). Surgical drains are often used in head and neck surgeries to prevent hematoma and seroma formation which can produce significant mass effect (18). Hence, drain insertion is necessary when larger surgeries are done where we expect seroma or even in surgeries that had significant intra-operative bleeding. However, surgical drain care can become a burden during the post-operative period. In addition to caring for their post-operative wound and post-operative instructions, patients have to also care for the drains to prevent it from being dislodged, or entangled; causing discomfort to the patient.

The main objective of this study was to assess the effectiveness of the drain support system in the post-operative care of parotid and thyroid patients. Based on the descriptive analysis from our data, the sample showed a predominant Malay distribution (85%) followed by Chinese (12.8%) and Indian (2.5%). The racial group for our study was divided as Malay and non-Malay as we only had one Indian patient **(Table 1)**. The racial distribution of case subjects were mostly from the Malay population, reflecting the racial predominance in Kelantan where Malays account for about 95% of the state population followed by other minority races including those of Chinese, Indian and other descent (19). The p-value of our racial descriptive data was not significant.

There was a significant difference between the type of surgeries (parotid and thyroid) that the patients underwent, with number of thyroid surgery in Redivest group and control group was 14 and 17 cases respectively and parotid surgery 7 and 1 cases respectively. The p-value being 0.049. However, based on literature review the pain levels in both these surgeries have been

characterized as the similar intermediate pain levels based on VAS (visual analogue score) (20). Nevertheless in our study, we were measuring the outcomes of the pain from drains via the drain support system rather than the surgery itself. With regards to the number of drains, our study showed a mean drain of 1.57 in the Redivest group and 1.50 drains in the control group respectively with insignificant p-value of 0.666.There are also literature stating that, with regards to the number of drains, studies in the line of gastrointestinal surgeries has shown that number of drains did not affect the outcome of complications of having a drain as opposed to having a drain and no drain (21). As for the age factor of our data, the mean age for the redivest group was 53.8 years old in the Redivest group and 44.3 years old in the control group and the p-value was significant 0.047 in our data. Literature review states that pain tolerance trend decreases steadily after the age of 60 in both males and females with pain tolerance being two-thirds to three-fourths of patient's age below 30 (22). The mean age group of our sample falls between the ages of 40 to 60 in our study. The hospital stay also showed insignificant values of p-value 0.194 with a 5.43 days in Redivest and 5.83 days in control group.

Post-operative drain significantly increase the pain score of patients on post-operative day one and also increases the risk of infection and leading to more morbidity (23). As a result, further pain by pulling and stretching the drain can worsen the pain. Pain score in our study was measured on day 3 because, on day 1 and day 2 patient may confuse the pain with the surgical wound pain as drain site is usually close to the surgical wound site. We are measuring the pain caused by the drain and can be explained by the pain pathway. We expect the surgical wound pain to improve on day three as seen in literatures (19). The surgical drain would still be in situ on day three and amount of analgesia given would have also been reduced. However, the pain will still be there when there is pulling and stretching of drainage tubes post operatively.

In our study, patients without the vest and with drains showed significant pain scores although a difference of single pain score reading with pain score being 1 in the Redivest group and 2 in the control group with p-value < 0.001. Pain in post-operative patients with drains is observed due to the stretching and pulling of drainage tubes. Drains are usually anchored with sutures and pulling and stretching of the drains causes tension at the drain site and the sutures on the skin. This will usually cause pain for the patient and can be very unpleasant especially during the post-operative period. Stretching and pulling of the drainage tube happens when there are no proper drain management and safekeeping.

Drains would be either left hanging or anchored to the bed. This can predispose the drains to being tangled with other hospital equipment and cause pulling and stretching, hence the pain. The reason for low pain scores in our study is because all patients post operatively had analgesia prescribed and by day 3 pain scores would have been reduced that some patient even gave "0 score" pain scores which was translates as "1 score" in our study. With the usage of the Redivest, there was reduced stretching and pulling of drainage tubes hence the lower pain scores in the Redivest group.

Pain score was used in the study, as it is the most easily demonstrable and widely recognized by the patient and staff. It evaluates the pain in a more objective form by the patient (24). Pain can be easily demonstrated in this form. Studies have found that pain and discomfort increase the patients' anxiety level. Health care providers providing care to these patients are suggested to take measures to reduce pain and anxiety in post-operative patients, to obtained maximum comfort level (10).

Post-operative drains causes discomfort to patients during the crucial post-operative period. By having a post-operative drain, ambulation and mobility of the patients will also be

restricted. The comfort in our study measures the comfort of having a post-operative drain, with reference to early mobilization, able to perform activities of daily living such as ambulating, eating, sitting up comfortably and using the sanitary facilities. The comfort level was measured by a likert scale to assess the method of anchoring mechanism which facilitates caring of drains during post-operative period, keeping the drains and bottle adequately and safely, and is the patient comfortable with having the anchoring mechanism employed to them and lastly will the patient recommend the anchoring mechanism employed to them to others. The Redivest however may cause some discomfort to patients as it is an additional clothing but the comfort of having no issues with the post-operative drains has proven better than the discomfort caused by the Redivest as an extra clothing. Furthermore, the vest is made up of a light weight breathable silk material. This is reflected based on our proforma, as patients would recommend the Redivest as a method of keeping the drains to other patients.

Early patient ambulation reduces complications of prolonged bed bound which includes bedsores, orthostatic pneumonias and weakness (25). The hospital experience will be shorter and a more pleasant stay when the comfort level is optimum (26).

In our study, there were no complications seen in both groups. The complications of having a drain, was statistically not significant with no P-value. This could be attributed to, all patients had their surgery done in Hospital Universiti Sains Malaysia which is a tertiary care center with experts in respective fields and with experience supporting staffs such as the nurses. Hence we would expect very minimal complications. A larger sample size may prove statistically significant in evaluating the reduction of complications of having a drain.

Drains pose a risk of complications including dislodgement, drain blockage, and infections (27, 28). Drains left unattended are prone to dislodgement as they are freely hanging on the bed or

by the side. The use of intra wound vacuum drains during the first 24 hours after surgery has been found to significantly decrease the rate of seroma formation (5). Hence, drain care is important to prevent dislodgement especially in the first 24 hours with reference to reducing the rate of seroma formation.

Dislodged drains on another perspective can cause progressive accumulation of fluid and when occurs at the head and neck region as in cases of thyroid surgery, they pose a risk of airway obstruction and a repeat exploration may be needed. Drain placement and care of drain is important in preventing post-operative seroma or hematoma formation where is the function of the drain would be lost if dislodged or becomes non-functional (29).

Drains left freely unattended in soiled grounds as in the toilets or by the patient's bed, predisposes to risks of ascending infection and they become a source for surgical site infections.(30) Surgical drains are prone to infection with prolong use (31). Hence, care of drain is necessary for early removal of drains to prevent infections. Post-operative drains using Redivest, are kept at higher levels and close to the patients preventing it from easily being soiled. As a result, it is safer to have drains within the Redivest as a post-operative drain support system.

In this study, a proforma was designed to facilitate the evaluation of effectiveness of post-operative drain support system. This proforma was validated via face validation and content validation for its usage. Validation was analyzed with SPSS version 22.0 the questionnaire was filled by the principal investigator.

Strengths and limitations

This study being a pilot study, can now be a guideline for further studies with regards to drain support system in aspects of sample size calculation in the event of a bigger scale study to look for complications of having a drain. This study can also be a reference for better care of drains post-operatively for a more comfortable hospital stay.

There were however limitations to our study in evaluation of the effectiveness. The limitations include the surgeons performing the surgery could not be standardized and different surgeons were involved in the surgeries and this was because of the limitation of cases to standardize the operating surgeons. However the technique used by all surgeons remained the same in the aspects of surgical principles. This could minimize the differences when it came to different surgeons. Due to the convenience sampling method used, and the limited number of thyroid and parotid surgeries in one center, no matching were done and further valuation of variables are needed and involving a multicenter study. Other limitation were analgesia used, as sample collected were from different surgeons and wards and there were different preferences of analgesia used. The hospital stay was also at the surgeon's discretion. Our findings may have limited external validity due to it being localized to a single center and was confined to a largely Malay sample.

Conclusion

This invention has proven beneficial to patients with post-operative drains and has made the hospital stay a comfortable and pleasant one. Pain scores have improved with the use of Redivest and comfort levels were better. Patients were found to tolerate the post-operative drains better with the Redivest.

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