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ORIGINAL ARTICLE

COMPARISON OF TRANSPARENT POLYURETHANE FILM AND STERILE GAUZE AS DRESSING MATERIALS FOR CENTRAL VENOUS ACCESS

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Abstract

Aim: The aim of our work was to detect differences in the use of semipermeable transparent film and sterile gauze in the incidence of infectious complications, tolerance to dressing material and dressing condition.

Methods: To file the enrolled 256 patients with an established central venous catheter admitted to the intensive care unit; the site of the central venous access of 128 patients was dressed with sterile gauze, and 128 patients with semipermeable film. We used the method of observation and the results were recorded in the research protocol during the period of central venous catheter use. In processing the empirical data, we used the method of inductive statistics.

Results: The results of statistical analysis show that the use of sterile gauze and semipermeable film incurred significant differences in the incidence of infectious complications. Statistically significant differences were observed in the durability of dressing and bandage skin irritation ($p<0.05$). Replacing sterile gauze was more frequent (989 times in 128 patients) than the replacement of semipermeable film (162 times in 128 patients). The cost of replacing sterile gauze was higher than the cost of replacing semipermeable film.

Conclusions: The results of the study showed significant differences in the use of semipermeable film and sterile gauze dressing. To use semipermeable film is more advantageous, on one hand in term of place protection from bacteria and fluid, on the other hand in term of visual inspection possibility as the film enables the skin to breathe. Finally usage of film is also economically more advantageous.

Key words: *central venous catheter; dressing materials; complications*

INTRODUCTION

Safe maintenance of a central venous catheter and relevant care of the catheter insertion site are essential strategies for the prevention of catheter infections in patients. This includes appropriate experience in all aspects of catheter care and use of appropriate dressing materials (Dougherty 2006, Vascular Access Services 2008). Guidelines from the Centre for Disease Control and Prevention (2002) and Royal College of Nursing (2010) recommend using a sterile, transparent, semi-permeable film to cover the catheter insertion site. It is suggested that the dressing is replaced every 7 days or sooner if it breaks, or if moisture is trapped under the dressing. If the patient is diaphoretic, insertion

site or bleeding, bypass the preferred use of sterile gauze before the film. When using sterile gauze it is important to assess it daily and change bandages every 24/48 hours. The dressing should be changed immediately if releasing, dirty or moist. Individual types of dressing materials can be changed as needed. The function of IV dressings is to provide an impermeable barrier to water and bacteria, protect the catheter site from external contamination, prevent the spread of bacterial growth at the catheter insertion site and ensure against displacement. Therefore, the bandage should be transparent (allows visual inspection), adhesive (ensures stability thus reducing the risk of damage, contamination and mechanical phlebitis), and semipermeable (location protects against bacteria and fluid, but allows skin to "breathe"). The aim of this research was to determine the differences between the semipermeable transparent film and sterile dressing materials for dressing the central venous access site in the incidence of infectious complications, tolerance dressing and frequency of dressing exchanges.

MATERIALS AND METHODS

The sample consisted of 256 patients who had central venous catheters introduced through the internal jugular vein or subclavian vein, for more than 7 days, broken down into 137 men and 119 women. The mean age of patients was 65.53±13.02, 27 to 94 years. Patients were classified into 7 groups of 94 patients with gastrointestinal cancer, 41 patients with inflammatory diseases of the digestive tract, 12 renal transplant patients, 12 patients after surgery in the leg arteries, 3 patients with polytrauma, 35 patients with a benign tumour in the digestive system and 59 with another diagnosis. The average length of use of the central venous catheter was 9.27±2.72, with a maximum duration of 21 days use. 128 patients had the central venous entry site treated with sterile gauze dressing every 24 hours, unless there was damage or dressing release, and 128 patients had the central venous access site treated with a semipermeable transparent film every 7 days if not previously damaged or released. This was primarily carried out under aseptic conditions. The catheter was inserted through the right internal jugular vein in 116 patients, and over the left internal jugular vein in 11 patients. Via the right subclavian vein in 107 patients and through the right subclavian vein and the left subclavian vein in 22 patients. 185 Catheters have one input, 70 catheters two inputs, and one catheter three inputs. Table 1 shows the characteristics of the sample broken down by the treatment of central venous access. To collect empirical data, we used the method of observation. The central venous catheter insertion site was inspected daily by part of the nursing staff intensive care unit. All line manipulations were performed by the intensive care unit nursing staff and managed according to current standards. The central venous catheter was not changed on a scheduled basis but removed for clinical suspicion (temperature >38 °C, haemodynamic instability) of sepsis (with the culture of the catheter tip and peripheral blood), mechanical failure, or when no longer required. The compilation of the research protocol, which includes the following items (swelling, redness, injection site pain, exudation, body temperature) recorded every day for their presence or absence. Further research protocols consisted of other items (the results of blood cultures, catheter tip culture results). The sampling of venous blood was collected at standard body temperature above 38 °C. The central venous catheter tip was removed and then immediately transferred to a sterile container and transported to the microbiology department at a temperature of >38 °C, where local symptoms infection and haemodynamic stability were present. We also recorded the exchange rate for each type of dressing and allergies using different types of dressing. These items were followed up for 7 days. For processing empirical data we used the method of inductive statistics. To reflect on the statistical differences between the various dressing materials, we used Student's t-test significance level of 5%.

Table 1. Characteristics of the sample examined

Characteristics sample	Film	Gauze
Patient Median age (x, SD, min., max.) Gender (M/F)	n=128 62.5 (63.70, 11.84, 30–89) 72 (56.25%) / 56 (43.75%)	n=128 69 (67.35, 13.87, 27–94) 65 (50.78%) / 63 (49.22%)
Diagnostic category Malignancy DS Inflammatory diseases DS Kidney transplant Venous diseases LW	 53 (41.40%) 26 (20.31%) 12 (9.37%) 11 (8.59%)	 41 (32.03%) 15 (11.71%) 0 (0%) 1 (0.79%)
Polytrauma Others diseases Benign tumour DS	 6 (4.68%) 32 (25%)	 53 (41.40%) 3 (2.35%)
Median long using CVC (x, SD, R)	8.5 (9.5, 3.03, 7–21)	8 (8.9, 2.35, 7–19)
Catheter	n=128	n=128
Location of the catheter VJI dx. VJI sin. VS dx. VS sin.	 101 (78.91%) 7 (5.47%) 18 (14.06%) 2 (1.56%)	 15 (11.72%) 4 (3.13%) 89 (69.53%) 20 (15.62)
Number of lumens 1 lumen 2 lumens 3 lumens	 92 (71.87%) 36 (28.13%) 0 (0%)	 93 (72.65%) 34 (26.57%) 1 (0.78%)

X – average; SD – standard deviation; min. – minimum; max. – maximum; DS – digestive system; LW – lower extremity; CVC – central venous catheter; VJI – vena jugularisinterna; VS – vena subclavia

RESULTS

Table 2 shows the incidence of symptoms using a sterile gauze dressing and semipermeable film. Based on the results of statistical analysis we can conclude that there is no statistically significant difference in the incidence of those complications ($p>0.05$). The most commonly reported ailment was flushing in 39 patients at entry in the treatment of the central venous catheter with semipermeable transparent film, and increased body temperature in 33 patients. Table 3 shows the incidence of micro-organisms isolated from blood cultures and Table 4 shows the incidence of micro-organisms isolated from the semi-quantitative culture tip of the catheter.

Table 2. The incidence of symptoms

Factor	Gauze	Film	P
Swelling	4 (3.12%)	1 (0.78%)	0.088
Redness	13 (10.15%)	39 (30.46%)	0.275
Pain	13 (10.15%)	14 (10.93%)	0.419
Exudation	1 (0.78%)	1 (0.78%)	0.500
↑ body temperature	25 (19.33%)	33 (25.78)	0.116
Blood cultures	16 (12.50%)	9 (7.03%)	0.388
Semi-quantitative culture tip of catheter	14 (10.93%)	20 (15.62%)	0.135

Table 3. Blood cultures

Dressing material	Gauze	Film
Negative	15	7
Escherichia coli	1	0
Enterococcus faecium	0	1
Gram-positive organisms	0	1
N	16	9

Table 4. Semi quantitative culture tip of catheter

Dressing material	Gauze	Film
Negative	3	3
Candida albicans	1	1
Escherichia coli	1	1
Klebsiellapneumoniae	0	1
Proteus mirabilis	1	0
Pseudomonas aeruginosa	3	0
Staphylococcus aureus	3	2
Staphylococcus epidermidis	2	11
Staphylococcus sp. coagulase negative	0	1
N	14	20

Table 5 shows the incidence of allergic reactions and the exchange rate of dressing material. Significant differences (p=0.006) were confirmed in the occurrence of allergic reactions (redness around the dressing). Redness around the dressing occurred in 13 patients which prevailed through the point of entry with a sterile gauze dressing, and 39 patients in whom the point of entry was prevailed in semipermeable transparent film. When replacing the cover for 7 days, we confirmed significant differences (p=0.046). When using sterile gauze dressing in 25 patients, the exchange was implemented more than once every 24 hours. The exchange of transparent semipermeable film was executed more than once every 7 days in 16 patients. We present the results of the financial costs of the different types of materials in Table 6. The price of 989 sterile gauze dressings was EUR 69.23, while the price of 162 bandages was EUR 59.94. The totals amount to only the price of materials.

Table 5. The incidence of allergic reactions and exchange frequency of dressing material

Factor	Gauze	Film	p
Allergic reaction	19 (14.84%)	7 (5.46%)	0.006
Exchange within 7 days	25 (19.53%)	16 (12.50%)	0.046

Table 6. Financial price of dressing material

	Number of dressings	Price (€)	Price of one dressing (€)
Gauze	989	69.23	0.07
Film	162	59.94	0.37

DISCUSSION

The type of dressing used is one of the many risk factors associated with central venous catheter infection, but there is still no consensus about the optimal type of dressing (Reynolds et al. 1997, Bishop et al. 2007). In our study no confirmed significant differences were witnessed in the incidence of complications such as swelling at the site of injection, redness and pain at the site of injection, exudation, and body temperature, which are determinants of infection at the site of central venous catheter introduction.

Larwood (2000), Hamilton and Bodenham (2009) stated that the type of dressing used to treat central venous catheter insertion site is one of the variables affecting the incidence of complications. The guidelines from the Centre for Disease Control and Prevention (2002) and Nyobe (2007) Pittiruti et al. (2008) recommended sterile transparent semipermeable dressing, unless the patient has no profuse sweating or if the place of insertion is not bleeding.

Gillies et al. (2003) in a systematic review of literature identified eight suitable studies (meta-analysis of six) in which they compared differences in the incidence of infection complications when using sterile gauze and sterile, transparent, semipermeable dressings. Those studies have identified significant differences in the incidence of infectious complications associated with the use of sterile gauze and sterile, transparent, semipermeable dressings. Guidelines from the Registered Nurses Association of Ontario (2005) and Royal College of Nursing (2010) and other studies (Treston-Aurend et al. 1997, Parker 2002, Volker 2002) recommended the use of a sterile transparent semipermeable film to cover the insertion site of the catheter in pursuance of evidence based practice. They suggested that the dressing is replaced every 7 days or sooner if it breaks, or if the moisture is trapped under the dressing.. If the patient is diaphoretic or the insertion site is bleeding, sterile gauze is preferred to be used instead of film. The using of sterile gauze is very important to make assessment and change bandages daily. If it is released and becomes dirty or if the dressing is moist, it should be changed immediately. Sterile gauze can be exchanged for the film as soon as possible.

In pursuit of dressing tolerance we studied the incidence of allergic reactions (redness around dressing material). We confirmed significant differences (p=0.006) in using a sterile gauze and transparent semipermeable film and the incidence of allergic reactions. 19 patients whom had their central venous entry site treated with sterile gauze and plaster fixation witnessed the occurrence of redness under the patch fixation. The fixing patch used in the treatment was non-woven and permeable to air and water vapour. 7 patients who had their central venous entry site treated with semipermeable transparent film also saw the occurrence of redness under the foil. Significant differences (p=0.046) were confirmed by the frequency of dressing exchange over 7 days, as the standard exchange was considered a replacement every 7 days when using semipermeable transparent film, and once every 24 hours when using sterile gauze. Several times the sterile gauze was exchanged due to an allergic reaction, excessive sweating, non-adherence of fixation patches, or bleeding from the catheter entry point. For this reason the financial cost of predominantly sterile gauze was higher (EUR 69.23) than the semipermeable transparent film (EUR 59.96). Although the price of one used sterile gauze was lower (EUR 0.07) than the semipermeable transparent film (EUR 0.37). The results demonstrated by both studies (Shivnan et al. 1991, Wille et al. 1993) showed that the semipermeable transparent film was safer, cost less and was needed for less time in the treatment when compared with sterile gauze.

CONCLUSIONS

Research did not confirm statistically significant differences in the use of transparent film and semipermeable sterile squares in the incidence of symptoms of infectious complications. Significant differences were confirmed in tolerance (allergy) to the dressing and dressing exchange frequency. The choice between transparent semipermeable film and sterile gauze depends on the current status of the injection site. If the patient is diaphoretic and the site insertion bleeding, it is appropriate to use sterile gauze. After the symptoms are resolved it is possible to

use a transparent semipermeable film which is more cost-effective, saves nurses' time in connection with the exchange rate, is easy to apply and remove. New antiseptic dressings, such as the chlorhexidine-impregnated foam dressing, are being used more often as research supports their benefits. In the meta-analysis, chlorhexidine-impregnated foam dressings were found to be effective in reducing bacterial colonisation at vascular sites and were identified with a trend toward reduced catheter-associated bloodstream infections (Alexander et al. 2010).

ETHICAL CONSIDERATIONS AND CONFLICT OF INTEREST

The study was approved by the ethics committee of Comenius University in Bratislava, Jessenius Faculty of Medicine in Martin. The authors declare that the study had no conflict of interest.

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