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Research Article

Advantages of Using Skin Glue in Port Catheter Placement in Oncology Patients

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Abstract

Objectives: The aim of this study is to reveal the advantages of N-Butyl-2-cyanoacrylate, which is used as skin glue (SG) in closing the port catheter incision site in oncology patients receiving chemotherapy (CT).

Methods: This study, patients who had a port catheter placed between January -December 2019 were included. A total of 76 port catheters were placed in 74 patients (32 females, 42 males). Thirty-seven patients were assigned to the control group, and their incision site was closed with sutures. Thirty-seven patients were assigned to the study group, and N-Butyl-2-cyanoacrylate was used. The patients' pain thresholds were evaluated using the Visual Analogue Scale (VAS).

Results: 37 patinets (17 females, 20 males, mean age: 57.27±15.79 SD years, range: 15-81) in the control group had their port pockets closed with sutures. The remaining 37 patients (15 females, 22 males, mean age: 58.13±15.79 SD years, range: 19-79) had SG applied. After the procedure, the skin was closed with traditional sutures in the control group and with SG in the other group.

Conclusion: In CT-planned oncology patients, the use of SG instead of traditional sutures is preferred and should be implemented more frequently to prevent complications, particularly infections.

Keywords: Skin glue, port catheter, chemotherapy, interventional oncology procedures.

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Surgical skin glues (SG) are alternative materials to traditional sutures that facilitate the closure of incisions in minor surgical procedures while reducing the procedure time. They offer numerous advantages compared to traditional sutures, and there are several studies recommending the use of glue instead of sutures for closing low-tension cutaneous tissues after minor surgical interventions.[1-6]

There are different types of surgical glues used for these purposes, such as fibrin, gelatin, and cyanoacrylates (CA). It is known that gelatin glue has cytotoxic effects,[7] while CA glue is stronger than fibrin glue. Moreover, CA glue can be applied to various tissues and is preferred due to its high polymerization property.[8] For these reasons, we chose to use N-Butyl-2-cyanoacrylate in our study.

When closing the incision made for the placement of a port catheter reservoir into the subcutaneous tissue, using glue instead of traditional sutures results in a faster and easier procedure. However, in most interventional radiology clinics, traditional sutures are more commonly used for incision closure.

One of the most common indications for port catheter placement is in patients requiring long-term permanent vascular access such as chemotherapy (CT).[9] Malignancy and the administration of CT can lead to immunosuppres-

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sion in these patients. Therefore, even local infections can progress to systemic infections and cause serious complications like sepsis.[10] When the incision is closed with SG, it creates a chemical barrier, prevents bleeding, and inhibits the formation of a nutrient-rich environment for bacteria.

Taking all these factors into consideration, this study was designed to evaluate the outcomes of SG application for skin closure during the placement of port catheters in oncology patients and compare it with traditional sutures. The advantages of shorter procedure duration, less traumatic and less painful experience, absence of foreign body reactions associated with suture materials, and lower risk of hypertrophic scar or keloid formation make glue usage a favorable option, particularly in terms of addressing aesthetic concerns.[11, 12]

Methods

Patients undergoing port catheter placement between January 2019 and December 2019 were included in the study. All patients were given detailed information and informed consent was obtained before the port catheter and subsequent skin closure procedures were performed. The retrospective study was approved by the local institutional ethics committee (ethics number 2019/0290). Demographic characteristics, laboratory and clinical information, as well as radiological imaging of the included patients were obtained from the hospital information system.

Patient Cohort and Preoperative Evaluation

The patient population sample was very small but this was designed to be more than a pilot study. All patients had a diagnosis of cancer and were scheduled to start CT. The inclusion criteria for the study were patients with patent right or left internal jugular vein (IJV) or subclavian veins and a patent superior vena cava (SVC), platelet count above 50,000 per mcL, and an INR below 1.5. Patients with dermatological problems or local infections in the right or left pectoral region, edema due to breast cancer surgery, platelet count below 50,000 per microliter, INR value above 1.5, bilateral jugular and/or subclavian vein occlusion based on color Doppler ultrasound, allergies to port catheter materials (polysulfone titanium, silicone, polyurethane), and patients who were anatomically unsuitable for port placement were excluded from the study. The pain experienced by patients during glue application and removal from the skin two weeks after the procedure was evaluated using a visual analog scale (VAS) ranging from 0 to 10.

Prophylactic antibiotics were not routinely administered before the procedure due to the lack of a definite consensus on their use in patients undergoing port placement.

Procedure for Port Catheter Placement

Prior to the procedure, appropriate veins were evaluated using ultrasound to determine the side of catheter insertion.

Initially, the shorter right central venous pathway was preferred (Fig. 1). In cases where there was stenosis/occlusion of the right central venous system, or in patients who had undergone right-sided surgery for breast cancer or had received radiation therapy in that area, left-sided access was established.

After the placement of the catheter and reservoir, the port reservoir was secured subcutaneously in the pectoral region using absorbable sutures in all patients. Subsequently, the cutaneous tissue between the approaching ends of the incision line was either closed by using conventional non-absorbable sutures or with ready-to-use N-Butyl-2-cyanoacrylate applied as a thin layer on the skin per availablity and proceduralist discretion (Fig. 2). Approximately 2 cc of Histoacryl Blue (N-Butyl-2-cyanoacrylate), used as tissue adhesive, was used in each patient.Two weeks after the procedure patients were followed-up to inspect the wound site.

Placement of the port was evaluated for technical success based on the catheter being positioned in the desired loca-

Figure 1. Port catheter placement in the right pectoral region.

Figure 2. Appearance of the thin layer of glue on the incision line after injection.

tion within the central veins, absence of catheter tip malposition, easy placement of the reservoir and closure of the cutaneous tissue with glue, intactness of the incision line, easy venous blood aspiration through the port with the Huber needle during post-procedure checks, and the ability to easily flush the catheter with saline and clean it.

Follow Up

Continuation of port functionality during the entire duration of CT was evaluated as clinical success.

Patients were called for follow-up visits at 24 hours, the first and second weeks, and the first month to evaluate the incision line. The incision line was observed to be completely closed two weeks after the glue was applied. However, when the patients returned for a follow-up appointment two weeks later, the area where the glue was applied had spontaneously separated. The very small amount of remaining glue on the incision line was then removed using sterile saline.The presence of wound dehiscence, bleeding, redness, and discharge were assessed. The functionality of the port during CT was noted from the oncology clinic records. Patients who couldn't attend the follow-up visits were contacted by phone, and any potential complications and complaints were documented in their files. Possible complications were classified according to the CIRSE guidelines.[13] The functionality of the port catheter was monitored throughout the duration of CT.

Statistic and Data Analysis

Descriptive statistics were calculated for the data. The Shapiro-Wilk normality test was used to evaluate the normal distribution of continuous variables. All data were presented as mean ± standard deviation, median, minimum-maximum, frequency, and percentage. For normally distributed continuous variables, the Student's t-test was used for comparisons, while the Mann-Whitney U test was used for comparisons of categorical parameters. Statistical analysis was conducted using IBM SPSS Statistics software (Version 22.0, IBM Corp., Armonk, NY). A p-value of <0.05 was considered statistically significant.

Results

The population consisted of 37 patients (M: 22, 59.5%) in the SG group and 37 patients (M: 20, 54.1%) in the group who received traditional sutures.The demographic characteristics, procedure details and specific oncological diagnoses of the patients are presented in Table 1 and Table 2.

Initially, all patients were assessed for right central vein catheterization and the right pectoral pocket for port catheter reservoir placement. In the SG and suture groups, two patients each had previous right venous occlusion due to previous procedures and two patients in SG group had significant edema in the right pectoral region after right breast cancer surgery and radiotherapy,

Table 1. Demographic data and measurements of port catheter

Variables	Suture-Value (n)	Glue-Value (n)
Age(y)		
Mean±SD	57.27±15.79	58.13±15.34
Range	15-81	19-79
Sex		
Male	20	22
Female	17	15
Port resorvoir location		
Right	35	33
Left	2	4
Reservoir diameter (F)		
6	1	2
7	8	9
8	28	26
Incision length (cm)		
3	10	6
4	27	31

Table 2. Oncological diagnoses of the patient and control group

Variable	Sutur-Value (n)	Glue-Value (n)
Diagnosis		
Colon cancer	17	16
Gastric cancer	3	3
Breast cancer	4	4
Prostate cancer	1	1
Lung cancer	-	1
Head and neck cancer	2	2
Lymphoma	9	10
Mesothelioma	1	-

so port catheter was implanted on the left side (n-TA: 4, 10.8%; n-suture: 2, 5.4

Two patients who had sutures for closure required port revision, while none of the patients who had TA required re-intervention. In all patients, the port catheter was successfully placed in the desired location during the initial procedure, resulting in a 100% technical success rate. The port catheters remained functional throughout the chemotherapy period, resulting in a 100% clinical success rate.

There was a statistically significant difference between the two groups in terms of the closure time of the incision. The closure time for the glue group was recorded as 20.40±2.97 (SD) seconds (range: 15-25), while for sutures, it was 191.08±18.52 (SD) seconds (range: 150-240).

During the procedure, the pain experienced during closure of the port pocket, removal of sutures at week 2, and removal of glue from the skin were evaluated using the Visual Analog Scale (VAS) ranging from 0 to 10. These were assessed as VAS-1 and VAS-2, respectively. There was no significant difference between the two groups in terms of VAS-1 scores, but a statistically significant difference was observed in VAS-2 scores . There was a significant difference between the two groups in terms of the number of dressing changes (p=0.036) (Table 3).

No major complications were observed in any of the patients. After a 4-hour observation period following the procedure, all patients were discharged. During the first and second weeks, as well as at the one-month follow-up, minor complications were observed in 9 patients with sutures and in 4 patients with TA. Among the patients with sutures, four showed redness on the skin. No findings suggestive of infection were observed in laboratory results and ultrasound examinations. Topical antibiotics were applied prophylactically. Two patients reported swelling in the area where the reservoir was located, and ultrasound examination of this area revealed edema in the subcutaneous fatty tissue in a linear pattern. As there was no decrease in Hb

Table 3. Procedure data

Variable	Sutur-Value (n)	Glue-Value (n)
Incision closure time (sn)		
Min.	150	15
Max.	240	25
Dressing gauz change		
1	--	24
2	22	13
3	15	--
VAS-1		
Min.	4	1
Max.	7	3
VAS-2		
Min.	2	1
Max.	5	3

levels or bleeding from the incision site, it was evaluated as edema. Significant regression of swelling was observed during the ultrasound control after two weeks. Two patients with complaints of tension and pain at the incision site were treated with topical analgesics. In the group that received glue, three patients had redness on the skin, and one patient experienced itching at the site of glue application. These symptoms improved with topical antibiotic and antihistamine treatment, respectively.

Discussion

The use of SG (N-Butyl-2-cyanoacrylate) in closing the incision site instead of traditional sutures has been found to be a safe and effective method in patients undergoing CT procedures. It not only prevents local infection but also provides a painless, aesthetic, and cost-effective alternative. SG are commonly used as an alternative to conventional sutures in surgical clinics outside of interventional radiology, and there are numerous studies in the literature supporting their safe and successful use.[4-8] Studies have also been conducted on the use of SG in closing the entry sites of central venous catheters (CVC). Wilkinson et al. demonstrated success in 30 patients by using SG instead of sutures for CVC placement.[14]

The placement of a port catheter is one of the frequently performed procedures in interventional radiology. It is a procedure that requires approximately a 3-4 cm incision through the skin and subcutaneous tissue, similar to minor surgical interventions. Traditional sutures are commonly used for skin closure. However, the use of glue instead of sutures provides many advantages and conveniences to both patients and the performing physician. Firstly, with this method, skin closure can be completed in a shorter time compared to traditional suturing. Stabilization is

achieved within approximately 10-15 seconds. If desired, the thin layer of glue applied during the procedure can be easily removed using acetone a few days later. Especially in obese patients or in cases where proper positioning and anatomical challenges exist, closing the cutaneous tissue and managing complications and treatment of the incision site can be more difficult than the insertion of the port catheter. In such situations, the use of SG makes the procedure much easier and can be completed in a short time.

In addition to patient satisfaction, the use of glue is also preferred for the comfort of the performing physician. In a study, it was stated that glue application after CVC placement is easier and preferred by physicians compared to sutures.[14-16] Referrals to interventional radiology clinics for port catheter placement is predominantly from oncology patients who require a permanent vascular access for pre-CT purposes. These patients are both immunosuppressed due to their primary diseases and the treatments they receive. Local infections in these patients can easily become systemic. Therefore, reducing the risk of local infection in these patients is crucial. SG also act as a physical barrier at the incision site when applied. This property helps prevent bacterial translocation.[17] This feature is similar to the use of specially prepared honey in surgical wound sites in oncology patients, which has been reported to have numerous positive effects on wound healing.[18]

Another feature of glue is its hemostatic effect, which results in less bleeding. The presence of hemostatic agents, such as glue, reduces the formation of granulation tissue at the incision site and prevents contamination.[16, 19] In a randomized controlled study by Prachanpanich et al. involving 150 patients with CVC placement, it was shown that glue reduced bleeding from the CVC insertion site, thus decreasing the risk of bacterial colonization and infection.[20] In another study conducted on ECMO cannulation, Bull et al. demonstrated that when SG was used as glue at the insertion sites, no bacterial growth was observed in the glue test plates, while all the test plates without glue showed bacterial growth ($p=0.002$).[21] Furthermore, this study also showed that glue prevented bacterial penetration along the tunnel from the cannula insertion site.[21] Due to its property of preventing the entry point of infection, glue has provided a cost-effective effect by reducing the length of stay of patients undergoing ECMO in the intensive care unit of the hospital.[21] Another study that involved the application of glue for epidural catheter fixation demonstrated that glue has a specific inhibitory effect on all gram-positive organisms, particularly on difficult-to-treat MRSA, thus preventing the formation of epidural catheter-related infections and abscess formation, and enabling the long-term use of the epidural catheter.[17,22]

Post-procedural bleeding from the incision site is a complication that can occur in patients with port catheters due to the large incision. Particularly, bleeding occurs in the first hour and within the first 24 hours (40% and 15%, respectively). Although these bleedings are venous in nature, if they persist, they can cause anxiety in patients. On the other hand, the use of glue has been shown to reduce the frequency of bleeding and even eliminate bleeding altogether due to its hemostatic properties.[23,16]

In our patients who received SG, the decrease in bleeding has led to a decrease in the number of dressing changes. Using SG is more cost-effective compared to suturing because it requires less local anesthetic and fewer gauze dressings. Additionally, an important factor contributing to additional costs is the potential dysfunction of the implanted port catheter when its stabilization is not optimal. In such cases, the catheter may need to be replaced with a new one. It is known that SG is more effective than sutures in stabilization, preventing catheter mobilization and dysfunction. Studies have also been conducted in the literature showing that when SG is used following CVC placement, it reduces the forward or backward mobility of the catheter from the insertion site.[23,20]

Patients often experience anxiety and concerns about cosmetic issues following interventional procedures. When glue is used, the appearance of the incision line is more natural. Suturing, on the other hand, can increase the risk of keloid formation due to the individual needle insertions and the potential for scar tissue formation caused by the suture material. In contrast, the use of SG in closure eliminates the painful process of suturing and avoids damage to the skin from individual needle insertions during suturing and removal, which can have positive effects on cosmetic outcomes.[24]

The pectoral region is one of the most common locations for the development of aesthetic problems such as keloids following surgical scarring. In traditional suturing, the foreign body reaction associated with the suture material, which remains in the skin for approximately two weeks, along with increased tension on the skin, can lead to the formation of hypertrophic scars or keloid tissue along the incision line.[11,12]

We have not come across a study demonstrating the advantages of using SG instead of traditional sutures for closing the short incision line, especially for closing the port pocket in interventional radiological procedures. Considering the advantages it offers to specialized patients, such as those undergoing CT , most of whom are immunosuppressed, and the absence of a similar study previously conducted, our study's importance is increased.

Our study had some limitations. Our most significant limitation was the small number of patients in our study. This was primarily due to insufficient availability of glue. Due to the limited accessibility of glue compared to traditional sutures, only a small number of patients could receive SG within a certain time frame. Our second limitation was that it was a retrospective study conducted in a single center.A homogeneous group could not be formed as not all patients were fitted with the same brand and size of ports. Studies involving a larger patient population and establishing a general consensus can provide a clearer understanding of the importance of SG in these minimally invasive procedures. Our study serves as a reminder to the performing physicians that glue can be used in this manner and shows that it can potentially become a routine practice.

Conclusion

In conclusion, our study has demonstrated that the use of SG for the closure of port catheter incisions in immunosuppressed oncology patients undergoing CT, is a readily applicable and safe method. This simple and reliable procedure, which is highly important for patients, helps prevent various complications, particularly infections. The significance of glue usage will be better understood when controlled prospective studies are conducted with larger patient populations and in different applications.

Disclosures

Ethics Committee Approval: Istanbul Medeniyet University Göztepe Training and Research Hospital Clinical Research Ethics Committee (protocol number: 2019/0290).

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