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Original article

The Nursing Management of Tourniquet: the infective risk related to its use

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Summary. *Background and aim of the work:* Reusable tourniquets should be considered and used in clinical practice as semi-critical devices, as they are colonized by potentially pathogenic agents, a possible cause of care-related infections. The aim of the study was to analyse the management of tourniquets in the clinical reality of wards, investigating the aspects related to their use in venepuncture procedures, the cleaning process after their use and storage. *Methods:* It has been conducted an observational study with a questionnaire on a sample of nurses (N = 73) and nursing students (N = 60) recruited in a hospital and in an University of northern Italy. *Results:* Data revealed a very positive attitude regarding the high standards of hand hygiene among nurses and nursing students sampled; the critical issues concern the lack of shared protocols or guidelines for the management of tourniquets that lead to discussion both on their use in clinical practice and on the disinfection process after use as well as tourniquets disposal. *Conclusions:* Tourniquets can represent a serious potential danger in terms of infections transmission, especially in the pandemic period we are experiencing; their use is practically transversal in all healthcare settings and it is therefore necessary to implement the use of shared management and disposal guidelines / protocols. From this research it appears that in the setting explored, although much attention is paid to hand hygiene, this aspect still seems to be a critical point of nursing care.

Key words: Tourniquet, venepuncture, contamination risk, care-related infections, infection prevention, decontamination techniques, hand hygiene

Introduction

The tourniquet is an elastic device which, when tightened around a limb, exerts pressure to limit - but not to stop - the blood flow. It can be used in nursing procedures such as: placement of a peripheral venous catheter or performing a peripheral venous sampling; in emergencies; or in surgery, particularly in orthopedics.

The birth of the tourniquet has very distant roots, traceable to the first limb amputation operations, which date back to the Neolithic period. Over time, the tourniquet has found various fields of application, especially in warfare, up to the present day has led to changes mainly in the form and material of construction, but the functionality and purpose of their use has not changed.

Today the tourniquets on the market can be classified according to:
- shape: tubular or flat;
- material: latex, nitrile, silicone, velcro, fabric;
- extensibility: elastic or flexible;
- mode of closure: manual, velcro, clip-on/snap-on;
- type of use: arterial and venous;

- number of uses: disposable or reusable.

There are some possible complications related to the use of this device. It can cause damage to the tissues of a limb, such as: skin, muscles, blood vessels, and nerves. Another relevant complication related to its use is the potential risk of cross-infection due to tourniquet contamination. Several studies have shown that these devices are colonized by a variety of potentially pathogenic bacteria, and consecutive and shared use of the same tourniquet on many patients increases the risk of nosocomial infection as it can be transmitted from patient to patient at the hands of the healthcare professionals (1). Care-related infections pose a serious threat to patient safety, resulting in increased morbidity, mortality, prolonged hospital stay, and healthcare costs (2). There is a lack of information on proper decontamination procedures for reusable tourniquets after use. The latest guidelines recommend that tourniquets be single-use (3) and manufactured from a material with a low risk of microbial contamination, thereby discouraging the use of fabric tourniquets (4); health care organizations should ensure procedures for these to be disinfected between uses following the manufacturer's instructions (5). In the orthopedic setting, the contamination risk is even more worrisome because pneumatic tourniquets are used near the surgical wound, so they can infect surgical wounds (6). Relative to the potential contamination and infectious risk of the tourniquet the literature outlines four critical macro categories of device's management:

- microbiological status, the overall degree of contamination of the sampled tourniquets, thus the search for specific colonizing pathogens;
- the methods and timing of disinfection/decontamination;
- the compliance of healthcare workers with hygiene measures and observance of sanitation precautions during phlebotomy;
- the choice, based on comparison, of different types of garments: disposable tourniquets and reusable tourniquets; plastic tourniquets and fabric tourniquets; silicone tourniquets and conventional fabric tourniquets with clips.

Considering as a sample all tourniquets analysed in the complexity of all studies involved in the review, the percentage of tourniquets colonized by pathogens is between 34% and 100%. The sample of tourniquets is colonized by pathogens at a rate of 34% to 100%. The tourniquets analysed are composed of different materials and come from different care settings. Tourniquets from intensive care units have the highest colonization rate compared with other wards and outpatient clinics (7). Only in high-risk wards did the isolated species have a pattern of susceptibility to antibiotics (8). Colony counts in trauma hospitals are up to 400% higher than in elective hospitals (9). The most frequently isolated bacterium is coagulase-negative Staphylococcus spp. (74.6% - 96%). Specific analyses regarding methicillin sensitivity and antimicrobial resistance reveal a percentage between 1.9% and 3.3% of methicillin-sensitive Staphylococcus aureus, MSSA and a percentage between 1.4% and 26% of methicillin-resistant Staphylococcus aureus, MRSA. The literature indicates that there are no nationally standardized guidelines or protocols for the proper disinfection of this garment. The following methods have been proposed as solutions for venipuncture: the use of Trigene disinfectant (10); the disinfection with 70% alcohol-based solution and autoclaving (11); and the use of mikrozid® premium universal disinfectant wipes or Schülke wipes soaked in terralin® protect (12). As solution in the orthopedic setting, however: the implementation with cleansing with clinell® wipes for 5' (6); preferring disinfection with alcohol-free wipes or 70% isopropyl alcohol-based wipes over treatment with water, soap, and non sterile paper towels (9); sterilization (13); the use of two antiseptics, Savlon® and Sterillium® (14); and soaking the tourniquet for 30' in sodium hypochlorite (15). All studies dealing with the hygiene aspect, to support its importance in the prevention of this risk (16 - 8 - 17). Some studies have addressed the issue of handwashing by specifying when handwashing is performed, whether before or after venipuncture procedures (18 - 19 - 16 - 20 - 17 - 8). Other studies have addressed the issue of hygiene by focusing on the use of gloves (20 - 18 - 19 - 21 - 17 - 22). Combining the results of the studies, it can be stated that handwashing adherence rates among healthcare providers prior to venipuncture procedures ranged from 0.4% to 37.1%. A range of operators between 19.4% and more than 90% did not wash their hands before the procedure. After performing peripheral venipuncture, a range of 14% to 61.3% of practitioners washed their hands. At the end

of the procedure, a percentage of the sample between 1.6% and 75% did not wash their hands. Other studies have addressed the issue of hygiene by focusing on the use of gloves (20 - 18 - 19 - 21 - 17 - 22). Crossing the results of the studies, it can be stated that during peripheral venipuncture, glove use is performed as follows: percentages of practitioners between 4.9% and 48% always wore gloves; among those who did, between 21.4% and 92% did not change gloves between patients, the glove was not immediately disposed of after the procedure by approximately 23.3% of the sample; percentages between 37% and 68.8% of practitioners never wore gloves during phlebotomy. Disposable tourniquets may be a viable alternative to replace reusable tourniquets and mitigate the risk of contamination.

Objective

The study, conducted on a sample made up of nurses and nursing students in a hospital and a university in northern Italy, aimed to verify whether there were recommendations or practices shared between the various units/wards for the management of the tourniquet. The study stemmed from the interest in seeing the results of the research reflected in the reality of the ward, raising awareness of the issue in order to create a solving protocol. The decision to involve students and nurses stems both from the fact that there is no evidence in the literature of the simultaneous involvement in studies on the topic and the desire to raise awareness on the problem to try to stop the chain of malpractice by focusing on new awareness and education.

Method

Design

Observational and descriptive study, conducted in the period from January to May 2020.

Setting

This study has been carried with a sample of undergraduate nursing students and with a sample of nurses in a University Hospital; both the University and the hospital were in northern Italy.

Sample

As already specified a convenience sample of students and nurses was involved. The first sample, 60 undergraduate nursing students, were recruited selected based on a single criterion: at least one internship experience completed, during which they had experienced two nursing procedures: performing blood sampling and inserting a peripheral venous catheter; for this reason, we proposed the survey exclusively to third year students. The second sample was composed of 73 nurses of various Units/Wards (excluding Outpatient Units and/or Day Hospital services) from a hospital in northern Italy.

Procedure

The students were invited by email to voluntarily participate in the study. In the email explicit reference was made to the legal regulations for the guarantee of privacy specifying that: the study project did not provide for data collection with invasive or intrusive methods; 2) the project did not provide for the collection or dissemination of sensitive data from which the participants could have been traced, thus maintaining absolute anonymity. The students were then invited to fill in the questionnaire created with the cloud Google Drive®, with access to be made via link and with automatic registration of the responses; it has eventually predisposed the obligation to fill in all the fields under penalty of impossibility to complete the delivery. A total of 100 questionnaires were sent by mail and a total of 60 were returned; then 60% of the submitted questionnaires were completed. As regards nurses we used the same recruitment procedure used with the students: an invitation via mail to fill in the questionnaire created with the cloud Google Drive® and a similar task of filling in. A total of 100 questionnaires were sent by mail and 73 (73%) were completed and returned. In total we than received 133 questionnaires all deemed valid once verified that were all full completed and none presented ceiling or floor effect.

Instrument

The 14-item-questionnaire (Fig. 1) was created ad-hoc taking a cue from the tool used in the study by Culjak et al. (8) composed of 9 items.

For the translation of the items of the original

format (all in English) the back-translation-method was used: three independent researchers proceeded with the Italian translation and through comparison and discussion they created a shared version. Then, an English mother-tongue researcher proceeded with the English translation of the Italian version produced. In the original documentation (8), seven items were requested for translation into Italian (items 3, 4, 5, 7, 10, 11, 12 for all the participants), two items were excluded because they were deemed not relevant to our research field and six items (items 1 and 2, specific for nurses; 6, 8, 9, 13 for all the participants) were added, in order to be able to compare more aspects of the management of tourniquets between the reality of the wards and the conclusions drawn from the literature review and to obtain more information related to the whole "process" of blood sample drawing (not only before performing the procedure). To conclude the questionnaire review process, a pilot study was conducted on a sample of 10 nurses, to confirm the easy understanding of the items and the clarity of the answer options. In the initial part, a brief description of the research was provided, reaffirming the principles described for the guarantee of anonymity; the first question, for all the participants, was used to define the role/profession (nurse or student). The questionnaire used for the students was composed of 11 items and provided for the possibility of answering with two, three or four options. An example of one question is: *"How frequently do you wash your hands BEFORE each blood sampling?"*. With the nurses we used a 13-item questionnaire, the same one used for the student survey with the addition of two items; the first one to investigate the use of a protocol for the disposal of obsolete tourniquets (*"Does a protocol exist in your Unit/Ward for the disposal of tourniquets?)* and the second one to understand if shared protocols/guidelines were used for correct disinfection *("Do protocols/guidelines exist in your Unit/Ward for the correct disinfection of tourniquets'?*).

Data analysis.

All the descriptive analysis (frequencies and percentages) and the χ^2 tests (with adjusted standardized residuals) were computed through the IBM SPSS statistical program®, Statistics Version 23.0 software package (IBM Corp. 2014).

Table 1. Instrument: 14-item-questionnaire translated and adapted from Culjak et al. (8)

Questions	Answer options
1) Profession/role	a. Student
	b. Nurse
Questions only for nurses:	
2) Does a protocol exist in your Unit/Ward for the disposal of tourniquets?	a. yes
	b. No
3) Do protocols/guidelines exist in your Unit/Ward for the correct disinfection of tourniquets?	a. yes
	b. No
Questions for nurses and students:	
4) What kind of tourniquet do you use?	a. Plastic
	b. Rubber
	c. Fabric
	d. Other
5) What is the daily use of the tourniquet (number of patients per day)?	a. 1–5 patients/day
	b. 6–10 patients/day
	c. 11–20 patients/day
	d. >20 patients/day
6) Is tourniquet personal or shared with colleagues?	a. Personal
	b. Shared
	c. It depends
7) Where do you keep/store the tourniquet you use?	a. Uniform pocket
	b. Nursing station
	c. Drugs trolley
	d. Venipuncture material drawer
	e. Other
8) How frequently do you perform hand hygiene BEFORE each blood sampling?	a. Always
	b. Often
	c. Sometimes
	d. Never
9) How frequently do you perform hand hygiene BETWEEN one blood sampling and the other?	a. Always
	b. Often
	c. Sometimes
	d. Never
10) How frequently do you perform hand hygiene AFTER each blood sampling?	a. Always
	b. Often
	c. Sometimes
	d. Never
11) How frequently do you use a new pair of gloves to perform a blood sampling?	a. Always
	b. Often
	c. Sometimes
	d. Never

Table 1. Instrument: 14-item-questionnaire translated and adapted from Culjak et al. (8)

Questions	Answer options
12) How frequently do you clean/wash the tourniquet AFTER use?	a. Always
	b. Often
	c. Sometimes
	d. Never
13) How frequently do you disinfect the tourniquet AFTER use?	a. Always
	b. Often
	c. Sometimes
	d. Never
14) Do you think that the tourniquet can be a vehicle for infections?	a. Yes
	b. No

Ethical implications

Participation was voluntary; participants (nursing students and nurses) were informed that any information given was strictly confidential and used exclusively for the research's purposes and that no personal information will be used to identify the author (in accordance with the regulation UE n. 2016/679, issued April 27th, 2016, published on EU Official Journal on May 4th, 2016, came into force on May 25th, 2016, and executive since May 25th). Consent was required to participate in the study and complete the questionnaire.

Results

The whole sample, 133 professionals involved in the study is divided almost equally between 60 (45.1%) third-year undergraduate nursing students and 73 (54.9%) nurses.

Question 2-3, nurses' answers.

Table 2 shows the results of the two questions addressed exclusively to nurses. As regards the first one *"Does a protocol exist in your Unit/Ward for the disposal of tourniquets?"*, most of the nurses, 63 (86.3%), stated that in their Unit/Ward there were no protocols or guidelines for correct disinfection and only 10 (13.7%) nurses positively responded. The answers to the second question too, *"Do protocols/guidelines exist in your Unit/Ward for the correct disinfection of tourniquets?"* didn't not show encouraging results, 64 nurses (87.7%) in fact declared that in their Units/wards there weren't protocols or guidelines for their proper disposal; with a positive response from only 9 (12.3%) nurses.

Table 2 . Nurses answers to the questions 2-3

	Yes	No
Does a protocol exist in your Unit/ Ward for the disposal of tourniquets?	10 (13.7%)	63 (86.3%)
Do protocols/guidelines exist in your Unit/Ward for the correct disinfection of tourniquets?	9 (12.3%)	64 (87.7%)

Question 4-14, nurses and students' answers.

From here on, the questions were for all the participants. Table 3 highlights the most used types (materials) of tourniquets; as regards the question 4 "*what kind of tourniquet do you use?*" were indicated 4 possibilities of answer: rubber, plastic, fabric, and others (e.g. nitrile, silicone and velcro). The most used were the rubber ones, used in total by 103 (77.4%) which consisted of 48 students and 55 nurses; followed by plastic ones, used by 20 (15%) 8 students and 12 nurses. Occasionally, fabric ones were also used, only 3 (2.3%, 1 student and 3 nurses) professionals confirmed that, while the use of nitrile, silicone and/or velcro tourniquets, 7 (5.3%, 3 students and 4 nurses) was relatively scarce.

Table 4 shows the answers to the 5th question: "*What is the daily use of the tourniquet (number of patients per day)?*", with 4 possible response ranges: 1-5 patients per day, 6-10, 11-20, > 20. In general, there was a higher frequency in the range 1-5 patients per day, for a total of 74 preferences (55.6%), of which 50 nurses and 24 students. A significant number of students (22) rather than a lower number of nurses (10), claimed to use the tourniquet with 6-10 patients per day (total 32; 24.1 %); the frequency of both students

Table 3. Kinds of torniquet used: materials

	rubber	*plastic*	*fabric*	*others (nitrile, silicone, veltro)*
Nurses	55	12	2	4
Students	48	8	1	3
Total	103 (77.4%)	20 (15.0%)	3 (2.3%)	7 (5.3%)

Tab. 4 – Answers to the question "What is the daily use of the tourniquet (number of patients per day)?"

	1-5 patients/day	*6-10 patients/day*	*1-20 patients/day*	*>20 patients/day*
Nurses	50	10	9	4
Students	24	22	11	3
Total	74 (55.6 %)	32 (24.1 %)	20 (15.1 %)	7 (5.3%)

(11) and nurses (9) using the tourniquet on 11-20 patients per day decreased (total 20; 15.1%); finally, only 7 (5.3 %) between nurses (4) and students (3) used the tourniquet with a frequency of more than 20 people per day.

Table 5 shows the answers to the 6th question *"Is tourniquet personal or shared with colleagues?"*; 3 modalities of answering were foreseen: "personal", "shared" or "it depends". More than half of the respondents, 84 (63.2%), declared to use a tourniquet shared with colleagues; most of them students, 46 and a good number of nurses, 38. They exclusively used their personal tourniquet 39 (29.3%) of the participants and we can see from the data a reversal of the trend with a greater representation of nurses, 29, and an even lower representation of students, only 10. Very small and almost identical numbers among those who responded, "it depends" (indiscriminately use both their own or shared with colleague's tourniquet), 6 nurses and 4 students. Differences which were however significant in the comparison between the three classes (χ^2 (2) = 9.236, $p < 0.05$); the analysis of the adjusted residuals (data in bold) indicates that the significant differences are reported between two classes, "personal" (nurses Adj. Res. = 2.9; students Adj. Res. -2.9) and "shared" (nurses Adj. Res. = -2.9; students Adj. Res. 2.9).

Table 6 shows the answers to the 7th question *"Where do you keep/store the tourniquet you use?"*, with five possibilities of answer (possible places of storage chosen according to the literature), including "other"; the participants could choose more than one option. In general, the two most indicated places to store the tourniquet were found to be "drug trolley", indicated by 31 nurses and 32 students and "venipuncture material drawer" option selected by 32 nurses and 26 students; among these 10 nurses and 14 students selected both answers. These two options were indicated by those who reported to share the tourniquet. Then followed the answer "uniform pocket", option chosen by 27 nurses and 21 students and "nursing station" chosen by only 1 nurse and 2 students; these two options were indicated by those who declared to use their personal tourniquet. Eventually 4 nurses and 1 student (5;

Table 5. Answers to the question "Is tourniquet personal or shared with colleagues?"

		Nurses	**Students**	**Total**
Personal	*Count*	29	10	**39**
	%	39.7%*	16.7%*	**29.3%****
	Exp.Count	21.4	17.6	
	Adj. res.	**2.9**	**-2.9**	
Shared	*Count*	38	46	**84**
	%	52,1%*	76,7%*	**63.2%****
	Exp.Count	46.1	37.9	
	Adj. res.	**-2.9**	**2.9**	
It depends	*Count*	6	4	**10**
	%	8.2%*	6.7%*	**7.5%****
	Exp.Count	5.5	4.5	
	Adj. res.	.3	-.3	
Total	*N*	73	60	133

*Note: Exp. Count = Expected Count; Adj. Res. = Adjusted Residuals; Adj. Res. in bold are those that exceed +/- 2; * = % of row; ** % of column*

Table 6. Answers to the question "Where do you keep/store the torniquette you use?"

	Drugs trolley	**Venipuncture material drawer**	**Uniform pocket**	**Nursing station**	**Other**	**Overall responses**
Nurses	31	32	27	1	4	95
Students	32	26	21	2	1	82
Total	63 (47.4 %)	58 (43.6 %)	48 (36.1 %)	3 (2.3 %)	5 (3.8 %)	177

3.8%) indicated the answer "other". We didn't perform a statistical analysis (χ^2 test) because the data doesn't respect Cochrane criterion (it is observed values with >20% of cells with values <5) (23).

Table 7 shows the answers from the question 8 to 13 and for this series of questions, a 4-option answer modality has been proposed: "always", "often", "sometimes" and "never". The question 8 was *"How frequently do you perform hand hygiene BEFORE each blood sampling?"*; 108 (81.2%) professionals 63 nurses and 45 students, declared that they "always" wash their hands before to perform it; 21 (15.8%) professionals 10 nurses and 11 students answered "often", and only 3 (2.3 %) students "sometimes"; 1 (0.8 %) student answered "never". The question 9 was "*How frequently do you perform hand hygiene BETWEEN one blood sampling and the other?"*. Between drawing one blood sampling and the other, 101 (76.1%) professionals, 59 nurses and 42 students claimed to "always" perform hand hygiene; 21 (15.8%) participants, 11 nurses and 10 students reported "often"; 9 (6.8%) of which 2 nurses and 7 students declared "sometimes", while 2 (1.5%) professionals, 1 student and 1 nurse concluded by stating "never" to do it. The answers to the following question 10 *"How frequently do you perform hand hygiene AFTER each blood sampling?"* show that after drawing a blood sample, 102 (76.7%) professionals, 56 nurses and 46 students declared that they had "always" washed their hands; followed by 25 (18.8%) participants, 15 nurses and 10 students claimed to wash them "often", there were 5 (3.8%), 2 nurses and 3 students who declared "sometimes" and only 1 (0.8%) student "never". We observed an almost unanimous response to the question 11 *"How frequently do you use a new pair of gloves to perform a blood sampling?"*; almost all the participants, 126 (94.7%) professionals, of which 69 nurses and 57 students, reported in fact to "always" change the pair of gloves, using a new one for each blood sample taking; 3 (2.3%) participants, 1 nurse and 2 students declared to change it "often" and again 3 (2.3%) of which 2 nurses and 1 student "sometimes"; only one nurse claimed "never" to change his gloves. The answers to the question 12 *"How frequently do you clean/wash the tourniquet AFTER use?"* show that the tourniquet was cleaned/washed "always" only by 20 nurses and 5 students, for a total of 25 (18.8%) professionals, while none even answered "often"; the greatest concentration of preferences was on "sometimes",

Table 7. Answers to the questions 8-13

		Always	Often	Sometimes	Never
How frequently do you perform hand hygiene BEFORE each blood sampling?	Nurses	63	10	0	0
	Students	45	11	3	1
	Total	108 (81.2 %)	21 (15.8 %)	3 (2.3 %)	1 (0.8 %)
"How frequently do you perform hand hygiene BETWEEN one blood sampling and the other?"	Nurses	59	11	2	1
	Students	42	10	7	1
	Total	101 (76.1 %)	21 (15.8 %)	9 (6.8 %)	2 (1.5 %)
"How frequently do you perform hand hygiene AFTER each blood sampling?"	Nurses	56	15	2	0
	Students	46	10	3	1
	Total	102 (76.7 %)	25 (18.8 %)	5 (3.8 %)	1 (0.8 %)
"How frequently do you use a new pair of gloves to perform a blood sampling?"	Nurses	69	1	2	1
	Students	57	2	1	0
	Total	126 (94.8 %)	3 (2.6 %)	3 (2.6 %)	1 (0.8 %)
"How frequently do you clean/wash the torniquet AFTER the use?"	Nurses	20	0	39	14
	Students	5	0	44	11
	Total	25 (18.8 %)	0	83 (62.4 %)	25 (18.8 %)
"How frequently do you disinfect the torniquet AFTER the use?"	Nurses	21	0	38	14
	Students	5	0	45	10
	Total	26 (19.5 %)	0	83 (62.4 %)	24 (18.1 %)

indicated by 83 (62.4%) participants, 39 nurses and 44 students and surprisingly 25 (18.8%), 14 nurses and 11 students declared that they "never" cleaned it after use. The penultimate question 13 was *"How frequently do you disinfect the tourniquet AFTER use?"*; the tourniquet, after use, was "always" disinfected only by 26 (19.5%) professionals, exactly 21 nurses and 5 students and again, even to this question, no one answered "often"; Most, 83 (62.4%) professionals, 38 nurses and 45 students, claimed to disinfect it "sometimes" after use and instead they were many, 24 (18.1%) 14 nurses and 10 students who declared that they "never" disinfected the tourniquet after use.

Table 8 shows the answers to the 14th and last question of the survey *"Do you think that the tourniquet can be a vehicle for infections?"*. Most of the participants, 125 (94.0%) of which 68 nurses and 57 students, thought that tourniquet could be a vehicle for infections and there were only 8 (6.0%), 5 nurses and 3 students, who excluded this possibility.

Discussion

The questionnaire revealed an almost total absence of protocols and guidelines to be followed for the proper disinfection and disposal of tourniquets; it would therefore be very useful to provide coordinated indications for the proper management of these devices as suggested from Golder et al (1). Research shows a trend towards using reusable tourniquets made of a variety of materials: primarily rubber, but also plastic and fabric (2). None of the study participants stated that they use single-use tourniquets in clinical practice, although this would be a possible solution to the problem, as there are many settings where reusable tourniquets are used consecutively on a large number of people, results in line with Costa (5). This alternative would also eliminate the problem of sharing medical devices, which is favoured by students, who use the tourniquets in their caring practice without sanitising them between uses.

Table 8. Answers to the question "do you think that the tourniquet can be a vehicle for infections?"

	Yes	No
Nurses	68	5
Students	57	3
Total	125 (94.0 %)	8 (6.0 %)

From the data analysed, it appears that professionals are aware of the potential infectious danger represented by tourniquets; however, this awareness does not seem to be sufficient to systematically adopt the preventive hygiene and health behaviours that all health professionals should always implement. Less than one-fifth of the respondents always clean their tourniquet after using it for a procedure; the same percentage of respondents stated that they never clean or disinfect tourniquets after use. Most of the sample stated that they clean or disinfect the tourniquet 'sometimes' after use, which is completely ineffective. The main limitation of this study is represented by the fact that the survey was conducted on a small sample, which allows for feedback exclusively on the specific health setting investigated. The survey also does not allow us to better understand the practices regarding other types of pneumatic devices, as the questions focused exclusively on tourniquets for venipuncture.

Conclusions

In conclusion, in clinical practice, there is a high risk of contamination associated with the use of inadequately cleansed medical devices. Reusable tourniquets, given their high microbiological load, could represent a transmission vehicle for infection. The tourniquet, as a purely nursing device, should be stored and managed with more care, to limit negative outcomes for patients. Having already analysed in the field how tourniquets are managed by the care teams and compared the results with the literature, it would be interesting, in the future, to be able to put the solutions proposed in the literature into practice and to study further their implementation in the field, to better understand their effectiveness in reduction of complications related to the improper use of the device in the healthcare setting. The steps to be taken could be the shared adoption of a protocol, educating the care staff to systematically follow this protocol, and subsequently reporting its incidence in reducing care-related infections. A further suggestion for future studies, to compare the efficacy of different decontamination methods, could be the com-

parative microbiological analysis of the tourniquets to quantify the bacterial load before and after cleansing and disinfection. Finally, it should be remembered that the study was conducted in the pre-COVID phase, a historical period therefore in which perhaps less attention was paid to good clinical practice for preventing infections; it would be very interesting to conduct a survey aimed at involving different healthcare settings to understand how much and if the pandemic has affected the practice of using tourniquets.

It seems that in clinical practice, in the field of infection prevention, many important, yet elementary steps, still need to be taken; the problem should not be underestimated, even more so if we consider the historical period we are experiencing where prevention is more than ever of fundamental importance for the protection of people's safety. Nurses use tourniquets every day and unfortunately, this study seems to show that the danger of their improper use is quite underestimated.

Conflict of Interest: Each author declares that he or she has no commercial associations (e.g. consultancies, stock ownership, equity interest, patent/licensing arrangement etc.) that might pose a conflict of interest in connection with the submitted article.

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Annex 1 – Instrument: 14-item-questionnaire Italian translation and adaptation from Culjak et al. (8)

Domande		**Opzioni di Risposta**
1) Indica il tuo ruolo/professione	a.	Studente/studentessa
	b.	Infermiere/infermiera
Domande solo per infermieri:		
2) Nella tua U.O. esiste un protocollo per lo smaltimento dei lacci emostatici?	a.	Sì
	b.	No
3) Nella tua U.O. esistono protocolli/linee guida per la corretta disinfezione dei lacci emostatici?	a.	Sì
	b.	No
Domande per studenti e infermieri:		
4) Che tipo di laccio emostatico utilizzi ?	a.	Plastica
	b.	Gomma
	c.	Tessuto
	d.	Altro
5) Qual è l'utilizzo quotidiano del laccio emostatico (numero di pazienti al giorno)	a.	1–5 pazienti al giorno
	b.	6–10 pazienti al giorno
	c.	11–20 pazienti al giorno
	d.	>20 pazienti al giorno
6) Il laccio emostatico che utilizzi è personale o condiviso con i colleghi?	a.	Personale
	b.	Condiviso
	c.	Dipende
7) Dove conservi il laccio emostatico che utilizzi? (si possono segnare più opzioni di risposta)	a.	Nella tasca della divisa
	b.	Nell'armadietto in guardiola
	c.	Attaccato al carrello dei farmaci
	d.	Nel cassetto con i presidi per venipuntura
	e.	Altro
8) Con quale frequenza esegui il lavaggio delle mani PRIMA dell'esecuzione di ogni prelievo ematico?	a.	Sempre
	b.	Spesso
	c.	Qualche volta
	d.	Mai
9) Con quale frequenza esegui il lavaggio delle mani TRA un prelievo ematico e l'altro?	a.	Sempre
	b.	Spesso
	c.	Qualche volta
	d.	Mai
10) Con quale frequenza esegui il lavaggio delle mani DOPO l'esecuzione di ogni prelievo ematico?	a.	Sempre
	b.	Spesso
	c.	Qualche volta
	d.	Mai
11) Con quale frequenza utilizzi un nuovo paio di guanti per eseguire un prelievo ematico?	a.	Sempre
	b.	Spesso
	b.	Qualche volta
	c.	Mai
12) Con quale frequenza pulisci/detergi il laccio emostatico DOPO ciascun utilizzo?	a.	Sempre
	b.	Qualche volta
	c.	Mai
13) Con quale frequenza disinfetti il laccio emostatico DOPO ciascun utilizzo?	a.	Sempre
	b.	Qualche volta
	c.	Mai
14) Secondo te il laccio emostatico può essere un veicolo per le infezioni?	a.	Sì
	b.	No