นิพนธ์ต้นฉบับ

A preliminary report on the testing of the possibility of the in-house produced circuit for destroying the used evacuated two-ended needle, an invention

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Abstract:

A preliminary report on the testing of the possibility of the in-house produced circuit for destroying the used evacuated two-ended needle, an invention

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Despite the well-known dangers of bloodborne infection, uncounted hours of education on safe work practices and improved systems for needle disposal, many health care workers injure themselves with used needles every year. Needle stick injury is a common accident in medical practice. Currently, the recapping is not recommended. The needle scrapper is a device produced in order to reduce the risk of health care worker to blood-borne transmission from needle stick injury. However, there are only a few machines in use because of the high cost. The in-house production of such machines could solve this problem. In this study, we report our experience on the testing of the prototype circuit for destroying the used evacuated two-ended

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needle. We developed a prototype of the needle scrapper by using the simple circuit composing with the Alternative Current (AC) electricity source (home electricity 220 volts) and a transformer. The input is 220 volts, AC, 50 Hz. The output is 9 volt, AC, 1 ampere. The needle was placed as the bridge to complete the circuit. We performed our trial by testing the destruction of the needles. It is of interest that, after applying of one end of the needle in the prototype, the needle is heated and becomes red. However, we still detect the problem in real use with the melting of the rubber sleeve on the other ended of the evacuated needle. Therefore, we have to correct this problem to complete our invention in the future.

Key words: *needle scrapper*

บทคัดย่อ:

แม้ว่าอันตรายจากการสัมผัสสิ่งติดเชื้อในเลือดเป็นที่รู้กันดีในปัจจุบัน อุบัติการณ์การถูกเข็มตำของบุคลากรทางการแพทย์ยังคงมีรายงานอยู่ อุบัติเหตุดังกล่าวเป็นสิ่งที่พบได้บ่อย การสวมกลับเข็มถือเป็นข้อห้ามที่สำคัญ เครื่องทำลายเข็มจัดว่าเป็นอุปกรณ์ที่มีประโยชน์ในการลดความเสี่ยงจากโรคติดเชื้อจากถูกเข็มตำ อย่างไรก็ตาม เครื่องดังกล่าวยังมีใช้อย่างจำกัดเนื่องจากราคาแพง การสร้างเครื่องขึ้นใช้เองจึงนับว่ามีประโยชน์ เราได้รายงานประสบการณ์จากการลองใช้วงจรไฟฟ้าพื้นฐานอย่างง่ายที่ได้สร้างขึ้นเพื่อทดลองทำลายเข็มเจาะเลือดระบบสุญญากาศ 2 หัว เราใช้กระแสสลับไฟฟ้าและหม้อแปลง โดยมีค่า input 220 Volts, AC, 50 Hz. และ out put 9 Volt, AC, 1 Ampere ใช้ปลายเข็มด้านหนึ่งพาดเป็นสะพานให้ครบวงจร เมื่อครบวงจรจะทำให้เข็มร้อนแดงขึ้น จากการทดลองใช้พบว่าเข็มร้อนและแดงขึ้นได้จริง แต่มีปัญหาการละลายของพลาสติกหุ้มเข็มอีกด้านหนึ่ง การแก้ปัญหาดังกล่าวตลอดจนการพัฒนารูปทรงเครื่องมือรองรับวงจรดังกล่าวเป็นสิ่งที่ต้องทำต่อไป

คำสำคัญ: *เครื่องทำลายเข็ม*

Introduction

Venous blood specimen is necessary for many laboratory tests. Therefore, venipuncture is a very important medical procedure that all graduated physicians should perform correctly. Despite the well-known dangers of blood-borne infection, uncounted hours of education on safe work practices and improved systems for needle disposal, many health care workers injure themselves with used needles every year[1-2].

Universal precaution is specifically used for all patients[3-4]. However, some workers still have false attitude that wearing gloves is complicated and wasteful. Nevertheless, although they wear gloves according to the universal precaution, gloves do not protect against needlestick. Therefore, the incidences of needle stick injuires are still reported. The needle scrapper machine is introduced in order to cope with this problem. However, the needle scrapper currently used in Thailand is from aboard and is of high cost, therefore, it is not applicable. Although there is a previous study[5] reporting the production of the needle scrapper machine in Thailand, this concerned a machine for the simple needle not the vacuum needle. In this study, preliminary data on the trial of an electric circuit for needle destruction as a part of in-house production of the needle scrapper machine for destroying of the vacuum needle is reported.

Materials and methods

Primary assumption

We designed this invention in order to find an appropriate in-house needle scrapper machine for destroying the used evacuated needles (two-ended needles). Generally, the major way to destroy the contaminated germs in the used needle is heating. There are several ways to produce heat such as moist heat by boiling, flame burning and electrical heating.

In this study, we used the electrical heating because it is easier to control than the other methods. Here, we used the electricity as the tool for destroying the needles and we accepted that if the needle is heated till redness level, the germ is destroyed.

Setting

This study was performed at the Department of Laboratory Medicine, Faculty of Medicine, Chulalongkorn University, Bangkok, Thailand. The trial of the invention is still being performed at the same setting.

Invention

We developed an in-house electric circuit to be used as the party of the needle scrapper machine. The in-house circuit was produced as the simple circuit comprising an Alternating Current (AC) electricity source (home electricity 220 Volts) and a transformer. The input is 220 volts, AC, 50 Hz. The output is 9 volt, AC, 1 ampere. The needle was placed as the bridge to complete the circuit. The detail of the circuit are described in Figure 1.

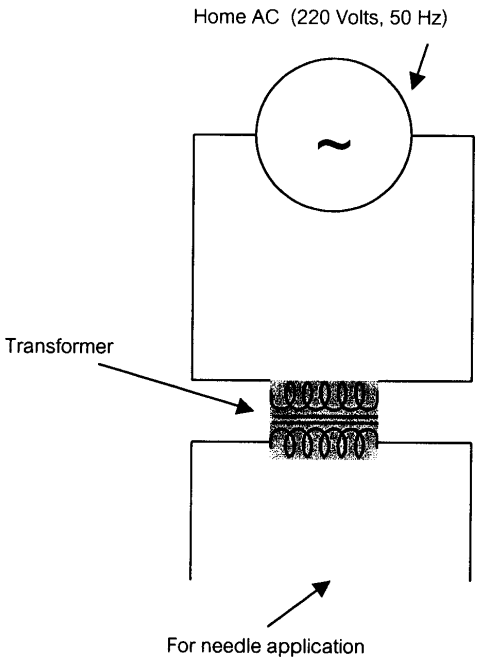

Figure 1 The diagram of electric circuit

Trials for needle destroying

We performed our trial by testing the destruction of the needles. Tens of needles were used for this evaluation. The two parts evaluated in destroying of the needles were a) the electrical circuit and b) the destroyed needles. The electrical circuit was tested for its ability to withstand the heat during use. The destroyed needles were tested for their temperature to see whether the germ would be killed. Nevertheless, we studied for the side effects of heat on the holder as well.

Result

Trials for needle destruction

Of interest, after applying one end of the needle in the prototype, the needle was heated and became red. However, we can use the circuit to destroy all needles without melting of any part of the circuit due to the heat produced during use. Concerning the destroyed needles, the tempe-ratures at both ends of the heated needles was more than 100 degree Celcius, which is the acceptable level for germicide. However, we detected a major con of our machine: the other end of the needle became melted and fixed to the holder at each application, which makes it necessity for the user to clean the holder after each use.

Cost comparison

The cost of the in-house electric circuit is about 50 baht. However, we have not yet produced or prepared it for distribution. We expect the total cost after the complete process will be about 100 baht. Compared to the routinely-used commercial machine, which costs about 1,500 bahts, our machine is much less expensive.

Discussion

Needle stick injury is a common accident in medical practice. Even though the risk of injury per use is low, so many needles are used in health care settings that even a very low injury rate translates into an imposing number of injuries[4]. Moreover, underreporting of needle-stick injuries is common[4]. Dealing with needle-stick injury is problematic. Currently,

the recapping is not recommended. If recapping cannot be avoided the best way is to recap a needle with a one-hand technique.

The needle scrapper is a device produced in order to reduce the risk of health care worker to blood-borne transmission from needle stick injury. However, there are only a few machines in use because of their high cost. The in-house production of such the machines can resolve this problem. There was a previous report of in-house needle scrapper in Thailand; however, it is produced for one-ended needle destroying[5]. Since the evacuated blood collection system has becomes a widely used blood collection technique[6], here we tried to create an in-house needle scrapper. In this study, we tried to set a very simple circuit as the prototype of development.

At first, we considered using the needle directly in contact with the home Alternative Current (AC) electricity. However, since the home electricity has high voltage, which can be dangerous to the user, we tried to use the transformer to decrease the voltage into a controllable level. The principle of needle destroying of this circuit is the "Short circuit". We connected one end of the circuit with the electrical source and left the other end naked. The applied needle for destroying worked as the electrical bridge. According to the basic electric principles, heat is generated when the electricity passes across the wire, therefore, our circuit is applicable. There are two important points for consideration according to the principles of electric heat of the machine. First, the destroyed needles should be evaluated for the temperature to make sure that the germ can be killed. Of interest, we can heat the needles to redness with more than 100 degree Celcius as the accepted level for germ destroying. Secondly, since the heat destroyed the wire and many parts of the circuit are wire, therefore, it was necessary to look for the probable destruction of the circuit during use. According to our study, although the needles melted, the circuit was still normal. In addition, the circuit was still normal even though we applied many needles and lasted the time of using. This finding can be well explained that the wire in the circuit is mainly copper while the needle is stainless nickel, is less resistance to heat. However, we still detect a problem in the real use of the melting of the rubber sleeve at the other end of the evacuated needle. Therefore, we have to correct this problem and complete our invention in the future. It can explained that the heat is transmitted from the heated needle to its covering, plastic sleeve and causes the sleeve to melt. We did not make the package of the circuit because of the persisting problem as already mentioned. If we can cope with this problem, we will make the decorated package and the new in-house machine will be a cost-effective machine.

Conclusion

The authors described the trial for the in-house produced electric circuit for destroying used vacuum needles. The principles of electric heat were applied. The needles can be heated to more than 100 degrees Celcius after closing the circuit. However, the problem of melting of the other end of the needle has been detected and requires further development before this machine can be put to real use.

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