

ິພນົມຕົ້ນລັບ (Original article)

Clean and Sterile Condition of Used Bulb Syringes for Orthopedic Surgery in the East of Thailand

Yutthana Khanasuk (M.D.)¹, Nattawut Sastravaha (M.D.)¹, Surapon Atiprayoon (M.D.)¹, Worasun Taweewuthisub (M.D.)¹ and Suwimol Chooprayoon (B.Sc.)².

¹Department of Orthopaedics, Queen Savang Vadhana Memorial Hospital

²Unit of Microbiology Laboratory, Queen Savang Vadhana Memorial Hospital

Abstract

Introduction Bulb syringe is a common tool in orthopedic surgery especially for the practices outside of Bangkok, Thailand. Some surgeons hesitate to use bulb syringes due to concerns over their sterility.

Purpose To identify the clean and the sterile conditions of bulb syringes.

Methods The authors sampled 20% of routinely used orthopedic bulb syringes from all public-orthopedic operable hospitals in the East of Thailand. These samples were dissected in sterile condition. The cleanliness was determined by their gross appearance inside of the ball and the sterility by swab culture their inner surface.

Results Fifty-two samples from 9 hospitals were examined. There were some clear fluid inside of most of the bulb syringes and a contamination stain was observed in some pieces, one of which looked like an old blood clot. However, the results of aerobic bacterial cultures were negative from all specimens.

Conclusion The bulb syringes are not able to achieve 100% cleanliness. Surgeons must be careful in using the bulb syringe in operations.

Keywords Bulb syringe, Clean, Sterility

Corresponding author Yutthana Khanasuk. Department of Orthopaedics,
Queen Savang Vadhana Memorial Hospital, Sriracha,
Chonburi, Thailand
Email: laobungchai@gmail.com

ความสะอาดและการปลอดเชื้อของลูกย่างแดงที่ใช้ในการผ่าตัดกระดูกและข้อของโรงพยาบาล ในภาคตะวันออกของประเทศไทย

ยุทธนา คงสุข (พ.บ.)¹ ณัฐวุฒิ ศาสตร์ราหা (พ.บ.)¹ สุรพล อธิประยูร(พ.บ.)¹ วรสันต์ ทวีวุฒิทรัพย์ (พ.บ.)¹ และ สุวิมล ชูประยูร (วท.บ.)²

¹ ฝ่ายศัลยกรรมกระดูกและข้อ โรงพยาบาลสมเด็จพระบรมราชเทวี ณ ศรีราชา

² หน่วยปฏิบัติการจุลชีววิทยา โรงพยาบาลสมเด็จพระบรมราชเทวี ณ ศรีราชา

บทคัดย่อ

บทนำ ลูกย่างแดงเป็นอุปกรณ์ที่ใช้ในการผ่าตัดกระดูกและข้อ โดยเฉพาะในโรงพยาบาลต่างจังหวัด ศัลยแพทย์ บางท่านไม่เลือกใช้ลูกย่างแดงเนื่องจากไม่มั่นใจในความสะอาดและการปลอดเชื้อของมัน

วัตถุประสงค์ เพื่อพิสูจน์ความสะอาดและการปลอดเชื้อของลูกย่างแดงที่ใช้เป็นประจำ

วัสดุและวิธีการ ผู้วิจัยสุมตัวอย่างลูกย่างแดงร้อยละ 20 ของลูกย่างแดงที่ใช้จริงในห้องผ่าตัดของโรงพยาบาล รัฐบาลที่สามารถผ่าตัดกระดูกและข้อได้ ในเขตภาคตะวันออกของประเทศไทย จำนวน นำลูกย่างแดงดังกล่าว มาผ่าดูพื้นผิวด้านใน ถึงความสะอาด และป้ายผนังของผิวด้านในส่งเพาะเชื้อแบคทีเรีย

ผลการศึกษา มีโรงพยาบาลที่ยังใช้ลูกย่างแดงในการผ่าตัดกระดูกและข้อจำนวน 9 โรงพยาบาล ได้จำนวนตัวอย่าง 52 ชิ้น หลังจากการผ่าดูด้านใน ส่วนมาก พบว่ามีน้ำใสๆ ปริมาณเล็กน้อยขอยู่ด้านใน บางชิ้นพบจุลสกปรก ที่น่าสนใจคือจุลสกปรกคล้ายก้อนเลือดอยู่ด้านใน แต่อย่างไรก็ดี ผลการเพาะเชื้อได้ผลลบทั้งหมด

สรุป ลูกย่างแดงไม่สามารถทำความสะอาดได้อย่างสมบูรณ์ แม้ว่าสิ่งสกปรกที่พบจะปลอดเชื้อ แต่ศัลยแพทย์ควร ใช้ความระมัดระวังในการใช้อุปกรณ์นี้ในการผ่าตัด

คำสำคัญ ลูกย่างแดง ความสะอาด ปลอดเชื้อ

ผู้นิพนธ์ที่รับผิดชอบ ยุทธนา คงสุข

โรงพยาบาลสมเด็จพระบรมราชเทวี ณ ศรีราชา อำเภอศรีราชา จังหวัดชลบุรี ประเทศไทย

Email: laobungchai@gmail.com

Introduction

Wound cleansing and irrigation are common processes in orthopedic operation to achieve sterile condition. Complications of infection in orthopedic surgery are difficult to treat, demanding high cost of treatment, increase the length of hospital stay and bring about late sequelae. Surgical site infections are therefore unacceptable, especially in elective cases and closed injuries.

Bulb syringes and Asepto syringes are common tools used for irrigation. They provide pressure of sterile saline or water to wash out contamination from the operation field. They are also cheap, reusable and easy to find. The drawbacks of the bulb syringes are uncertainty of sterility and cleanliness inside. Because the mechanism of bulb syringe is suction and squeezing like that of a one-way valve device. Nevertheless, it is difficult to cleanse the inner surface of the bulb syringe.

Previous studies described the sterile condition of bulb syringe were limited. Vatanasapt V et al stated the positive aspects of the bulb syringe in terms of cost-effectiveness, the sterility after reuse and recommended bulb syringes for any operation(1). Suprasuwankuk et al also reported safety in terms of sterile condition of re-sterilized bulb syringes after using detergent with tap water in cleansing(2). But the second report evaluated only the turbidity and the culture results from normal saline pushed out from a bulb syringe. These outcomes were not directly correlated with sterility.

According to the uncertainty of the sterile condition, some surgeons used other devices for irrigation such as Asepto syringe(3), disposable syringe or pulsatile lavage. The present study evaluated the cleanliness and sterile condition of the routinely used bulb syringes taken from orthopedics operations done in hospitals in the East of Thailand.

Materials and methods

The present study was a descriptive study which reports the cleanliness and sterile condition of used bulb syringes collected from orthopedic surgeries. The authors focused on samples taken from hospitals in the East region of Thailand, namely the provinces of Chonburi, Rayong, Chanthaburi, Trat, Chachoengsao, Prachinburi and Sakaeo where they have orthopedic surgeries.

Out of the fourteen hospitals that provided orthopedics surgeries, half of them are located in Chonburi. The Ethics Committee of Queen Savang Vadhana Memorial Hospital (QSVMH) as well as those all other participating hospitals have approved the project.

Bulb syringes collected in the present study were simple-randomly sampled. The authors selected only the bulb syringes that were ready to use in an orthopedic operation. The number of samples was 20% from the total bulb syringes available. After obtaining the samples, the examination of the bulb syringes were performed by one surgeon (YK) at the Department of Orthopedic Surgery of QSVMH.

Each sample was split along the midline with a surgical blade under sterile condition.

The cleanliness of the bulb syringes was described regarding their general appearances of inner surface after dissection. The sterile condition was identified with aerobic bacterial

swab culture in blood agar which is the most nutritionally rich media for 72 hours. The location of the swab was the top of the bulb, i.e., two centimeters below the top in four quadrants and the suspected areas of contamination. All specimens were incubated at the Department of Microbiology of QSMVH.

Results

Nine hospitals from the total of 14 in the Eastern part of Thailand that have orthopedic operation enrolled in the present study. The other five hospitals were excluded because bulb syringes were not used there. They used Asepto syringes.

The samples came from different places are shown in Table 1.

Table 1 Samples taken from the hospitals

Hospital	Total bulb syringe used	Number of samples	Packaging
A	20	4	Free piece
B	40	8	Free piece
C	15	3	Free piece
D	15	3	In the set
E	20	4	In the set
F	30	6	In the set
G	50	10	Free piece
H	20	4	Free piece
I	50	10	Free piece

Fifty-two samples were examined. The most popular size was number 5 that has the volume of 120 ml (range from number 4 (90 ml) to size 6 (150 ml).

Sterile processing

After using the bulb syringes, they were cleansed by suction and squeezing with tap water with added detergent. Then after they were dried, and packed into 2 systems.

First, they were packed independently: wrapped with double fabric layer or sealed with plastic bag. Second, they were packed within either the irrigation or specific orthopedic set. The sterile process was either steamed sterilization or gas sterilization.

Lifetime of bulb syringes

All the departments of surgery do not have criteria to discard the bulb syringes.

The common practice is throwing them away when they are out of order, having no suction or recoil effect. There is only one institution that recorded the numbers of their use by marking on the top of the bulb syringes.

Gross appearance of bulb syringes

External appearance

Bulb syringes were found in two types: one-piece bulb (Figure 1a, 1b) and two-piece bulb (Figure 1c). Thirty-two samples (60%) were one-piece type. Suction and recoil properties of all samples were intact.



Figure 1a demonstrated an one-piece bulb which the bulb of the syringe has one piece. The bulb is connect to the tube with connector.



Figure 1b Every one-piece bulb has rough surface at the connection.



Figure 1c demonstrated a two-piece bulb which the bulb of the bulb syringe has two pieces connected with glue. This type of bulb syringe has no connector to the tube so it has smooth surface at the neck.

Internal appearance

After cutting the sample along the midline under sterile condition, the internal surface was observed. Different surfaces depended on types of the bulb. One-piece bulb had rough surface while the two-piece type looked glossier. Figure 2 to 5 demonstrated the abnormal spot, stain or slough of some bulb syringes. The abnormal stain was observed in one-piece type 7/32 (22%) but only one appeared in one of the two-piece type (5%).

Apparently, one of them looked like an old blood clot stain on the internal surface (Figure 4). Most of the bulb syringes (84.6%) contained clear fluid from 0.5 to 3 ml. Only 8/52 (15.4%) were dry.

Figure 2 to 5 were demonstrated internal surface appearance of dissected bulb syringe.



Figure 2 demonstrated internal surface with abnormal dot and some water inside the bulb syringe.



Figure 3 demonstrated slough and contamination dot.



Figure 4 demonstrated a contamination stain looked like blood clot and some water inside the bulb syringe.

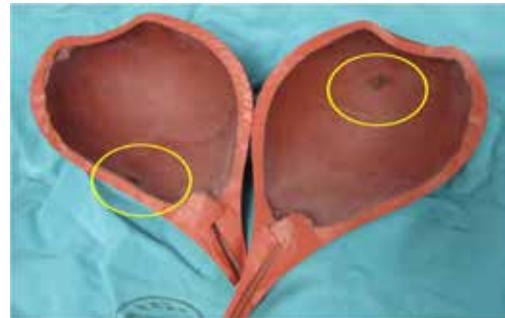


Figure 5 demonstrated two points of contamination.

Internal surface swab culture

All specimens yielded negative aerobic culture within three days.

Discussions

Bulb syringes are one of the common tools used in surgical operations in Thailand because they are easy to use, cheap, cost-effective and durable(1). However, the cleanliness and the sterile condition after re-sterilization are controversial. Re-sterilization of a bulb syringe is difficult because it has a one-way valve with small opening and opaque material that cannot represent the internal condition. The bulb syringes are not common used in orthopedic operation in developed country, disposable Asepto syringe or pulsatile lavage machine are more common.

Suprasuwankuk et al, reported safety of re-sterile bulb syringe after using detergent with tap water to cleanse the bulb syringe(2). Normal saline pushes from a bulb syringe were 98% clear and had negative aerobic culture. In this report might lead the false negative from the dilution effect of normal saline solution

and the turbidity was not correlated with sterility.

The present study was observational study of the cleanliness and sterile condition of the bulb syringes in the East of Thailand. Cluster sampling was used representing one regional apart of the capital city where bulb syringes are still commonly used in orthopedic operations. Five of the 14 hospitals (35.7%) discard the bulb syringe and use Asepto syringe instead. The rest of the hospitals (64.3%) still use bulb syringes in their orthopedic procedures. Most scrub nurses and some surgeons were concerned with the sterile condition as responses to the authors' questions.

Findings in the present study demonstrated the inner surface after dissection and did a culture via direct swab. This method had more accuracy than the previous study(2). Twenty-two percentage of the samples had abnormal spot or stain inside but the interesting thing was one sample contained with blood clot-like stain. This finding showed that bulb syringe could not achieve 100% clean. However, the internal surface swab culture of these samples were negative. The results indicated that contaminations were uninfected in our study.

Internal appearances created multiple concerns over the cleanliness and the sterile condition. Firstly, the rough surface may cause any foreign material stain easily such as blood clot, especially the bone dust when the bulb syringe is sucking in the fluid in the operative

field. Secondly, the surface inside the bulb syringe is not smooth. One-piece bulb syringe has a gutter at the connector between the tube and bulb. For two-piece bulb syringes, rough surface also present at the bulb. Thirdly, after cleansing with the tap water, the residual water may exist in the bulb syringe. Although the sample fluid yielded negative culture but the prolonged shelf time is already a risk of infection. Fourthly, some samples contained foreign materials inside the bulb syringe without any evidence of aerobic bacterial growth in the nutrition rich media. However, that was not a safe way to perform a sterile operation.

There are pros and cons in the use of safer devices for the surgical irrigation. Asepto syringe has a wider opening which is easier to clean. Furthermore, most Asepto syringes are made of transparent plastic material which is easily observable when there is contamination inside. Small bowl is also a common tool in a surgical set, but it does not provide pressurized water. Pulsatile lavage, on the other hand, is an expensive device and not cost-effective(4). Some surgeons prefer sterile irrigation tube to connect to a normal saline bag and let the fluid flow into the surgical field. Disposable syringe is also a favorable choice. It provides some pressure of releasing water but it provides less comfortable use. More advantage of disposable syringe is its very cheap price; however it increases waste product destruction.

The first limitation of the study was simple randomization which might not bring up a good representative of these devices. Second, the authors could not identify the age of the sample. Third, the author identified aerobic bacterial sterility. Some organisms such as fungus, atypical bacteria could not be identified. However, the incidence of fungal infection in orthopedic operation was not common^(5,6). Fourth, selection bias may occur because of the simple randomization of the samples.

The strength of the study was that it was the first study in the East of Thailand that split the bulb syringe to assess the cleanliness inside. The study also collected samples that came from all hospitals in the Eastern region that used the device.

Conclusion

The bulb syringes used in orthopedic surgery were not able to achieve 100% cleanliness; foreign materials may be contained inside. Although the internal surface swab culture was negative, surgeons must be careful in using bulb syringes in their operations.

Disclosure

No declared disclosure.

References

1. Vatanasapt V, Areemit S, Jeeravipoolvarn P, Kuyyakanond T, Kuptarnond C. Red rubber bulb, cheap and effective vacuum drainage. *J Med Assoc Thai.* 1989; 72: 193-7.
2. Suprasuwankuk W, Nitrat N. Rubber bulb syringe using in surgery: How to safely reuse and resterilize? *Lampang Med J.* 2011; 32: 89-96.
3. Ryan P. OR and central service question and answers. *Hospital Topics.* 2010; 61: 32-7.
4. Muñoz-Mahamud E, García S, Bori G, Martínez-Pastor JC, Zumbado JA, Riba J, Comparison of a low-pressure and a high-pressure pulsatile lavage during débridement for orthopaedic implant infection. *Arch Orthop Trauma Surg.* 2011; 131: 1233-8.
5. Gamaletsou MN, Rammaert B, Bueno MA, Moriyama B, Sipsas NV, Kontoyiannis DP, et al. Aspergillus osteomyelitis: epidemiology, clinical manifestations, management, and outcome. *J Infect.* 2014; 68: 478-93.
6. Bariteau JT, Waryasz GR, McDonnell M, Fischer SA, Hayda RA, Born CT. Fungal osteomyelitis and septic arthritis. *J Am Acad Orthop Surg.* 2014; 22: 390-401.