



Research Article

Reducing The Rate Of Contaminated Blood Cultures Collected In The Pediatrics Emergency Department: A Quality Improvement Project

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Abstract

BACKGROUND AND OBJECTIVES: Blood cultures are considered one of the most important and most commonly obtained diagnostic evaluations in febrile children without a clear focus of infection, and in sick children. Blood cultures can become contaminated during the process of collection. Due to its considerable consequences, contaminated blood cultures are a challenge to health care facilities especially in higher care centers where the frequency of performing this test is high.

METHODS: We compared the rate of contaminated blood cultures obtained in the pediatrics emergency department of our institution (7.2%) to the international benchmark (3%). Afterwards, a quality improvement project was initiated to address this problem using the Plan-Do-Study-Act (PDSA) methodology.

RESULTS: We noticed a significant drop in contaminated blood cultures obtained in the pediatrics emergency department upon completing the first cycle of PDSA.

CONCLUSION: Blood cultures contamination rate was successfully reduced in our pediatrics ED by educating the staff and emphasizing on aseptic collection techniques. These results were sustained on a long term but maintaining this success is a challenge and an ongoing project.

Keywords: Blood cultures contamination, Emergency department, Preventive Health, Quality Improvement

Introduction

Peripheral blood cultures are commonly obtained in the pediatric population to rule out bacteremia whenever a serious bacterial infection is suspected, or in young children when the source of fever cannot be identified by clinical history, physical examination and initial basic investigations. Blood cultures could become contaminated by inadvertent introduction of native skin bacteria into the specimen either from the patient or the care provider. Moreover, improper preparation and placement of

supplies can lead to accidental contamination of materials used in the collection process. The benchmark for acceptable blood cultures contamination rate in hospital settings has traditionally been a maximum of 3%.¹⁻⁴ Increased blood cultures contamination rate is known to be correlated with younger age groups as well as the experience of the healthcare worker performing the procedure.⁵

Contaminated blood cultures have significant negative impact on individual patients and the overall healthcare system. Examples of these include increasing hospital length of stay, causing unnecessary emergency department visits, unneeded tests and procedures; and unnecessary antibiotic use and their possible secondary adverse reactions and increasing antibiotics resistance.

All these negative consequences will increase hospitalization costs leading to negative impact on the economy of health care system.⁶⁻⁸

Methods

Study Design

Phase one: Development and implementation of a quality improvement project to reduce blood cultures contamination rate in the Pediatrics emergency department (ED)

Phase two: Evaluation of the effectiveness of this intervention. The intervention was developed using the plan-do-study-act (PDSA) cycle methodology. The effectiveness was then evaluated using data analysis of the contamination rate prior to and after our intervention. The local institutional Department of Performance and Innovation (DPI) and The Hospital's Ethical Committee approved the intervention and future publication.

Study Setting and Population: The study was conducted in the Pediatrics ED at Tawam Hospital, one of the largest community tertiary care hospitals in United Arab Emirates.

Study Protocol: During the period between January 2016 and September 2016, a high rate of contaminated blood cultures was observed, with the highest rate being from the Pediatrics ED (figure 1). Therefore, our Pediatrics ED was selected as the target of our intervention.

We started the study by observing the technique used by the nurses for blood cultures collection. There was no standardization of the procedure and significant variation in practice was present between different nurses. In general, it was noted that many nurses did not practice a strictly sterile technique during the procedure. The rate of contaminated blood cultures during this observation period was 7.3%.

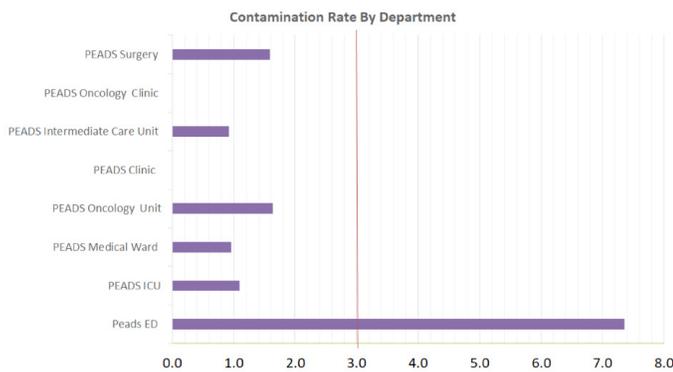


Figure 1: The rate of contaminated blood cultures, from all pediatrics departments (Jan- Sept 2016).

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Intervention Implementation and Effectiveness: Soon after the observation period, the intervention phase began. The main aim was to transform blood cultures collection technique from a “clean” to a “sterile” procedure. We started by conducting educational sessions in January 2017 to the nursing staff in the pediatrics ED. These sessions were done on semi-weekly basis to ensure the involvement of all the nurses doing different shifts (attendance recorded to ensure all nurses have attended at least once).

The educational sessions objectives were:

1. To reveal the fact that we have a high blood cultures contamination rate and that an immediate intervention is needed.
2. To inform the staff about our quality improvement project.
3. To educate and emphasize on the proper sterile technique of blood cultures collection

During those sessions, the nurses were provided a pocket checklist of the proper method of blood cultures collection, Figure 2. This checklist was adopted from the hospital's local clinical practice guideline.

Our sessions were completed by April 2017. The blood cultures contamination rate was then measured again and compared between the two eras: before, and after the intervention.

Blood culture collection procedure

- 1- Wash hands, cleanse the site of veni-puncture using one step method (one minute), if Chlorhexidine gluconate in 70% alcohol is not available then use the two step method (2 minutes)
* In case of allergy, use 70% Isopropyl alcohol.
* Chlorhexidine should not be used in children under the age of 2 months.
- 2- Prepare the site for culture
- 3- After the vessel site is selected, a **5 cm area of skin shall be disinfected**, in a circular movement outwards. **Let air dry for 30 seconds**. Do not palpate the skin again
- 4- Remove the plastic cap of each blood culture bottle, and the rubber stopper should be decontaminated with 70% Isopropyl alcohol and allowed to dry for 30 seconds.
- 5- Put on **sterile gloves**.
- 6- Blood shall be drawn into a syringe or directly into a culture bottle by using the vacutainer system.
- 7- Each veni-puncture attempt: a new withdrawal device should be used.
- 8- If blood is drawn into a syringe, the blood shall be discharged into the culture vials without changing needles.
- 9- Blood collected for blood cultures shall not be used for any other purposes before inoculating blood culture bottles
- 10- All bottles shall be labelled at the bedside, all samples should be kept at room temperature until sent to the lab.
- 11- Procedure will be documented in the patient's medical record

Figure 2: Checklist outlining optimal technique for using the sterile blood culture kit to collect a blood culture specimen. Each kit contained a checklist.

Results

The rate of contaminated blood cultures in 2016 from January to September from all pediatrics department divisions (ED, wards and clinics) in Tawam hospital are shown in Figure 1. Looking at the figure, pediatrics emergency department blood cultures contamination rate was the highest with the rate of 7.3%. This percentage was significantly above the acceptable blood cultures contamination rate published by the American Society of Microbiology, who stated that it should not exceed 3%¹.

After the completion of our educational sessions, there was a significant drop in the rate of contaminated blood cultures, when compared to the rate of same months a year earlier (across 6 months period), Figure 3. Rate of contaminated blood cultures over the next three years 2017-2019 are shown in Figure 4. There was consistent decrease for years after the intervention.



Figure 3: The rate of contaminated blood cultures, from pediatrics emergency department from January to July of 2016 and 2017, before and after intervention.

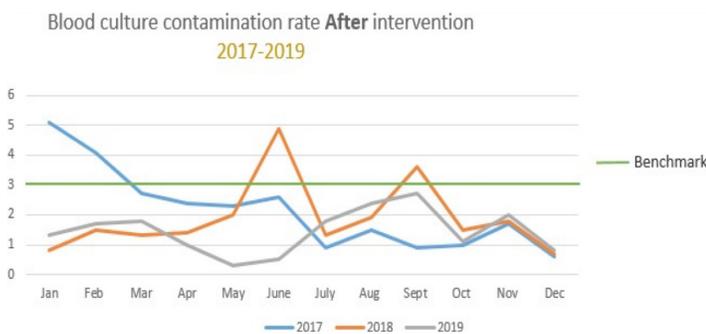


Figure 4: The rate of contaminated blood cultures, from pediatrics emergency department from January 2017 till December 2019, after the campaign. Relapse of the rate was noted in 2018 (in June and in September), but rates continue to be within the target afterwards.

Discussion

The concept of calculating contaminated blood cultures rate and monitoring this practice was new to the hospital culture, although a good list of other Key Performance Indicators (KPIs) were being monitored. An immediate action was deemed necessary not only to improve patients care but also to decrease and trim extra financial costs arising from dealing with such an avoidable problem.

We studied and observed the usual practice of our ED nurses in collecting blood cultures. A big gap was noticed between the hospital practice guidelines –which dictates an aseptic collection-, and the actual practice -which was the conventional clean method-. The reason behind this shift in practice was not clear to us, but is probably stemming from multiple reasons. It could be largely attributed to the nature of the staff work, which is usually shielded from knowing the negative consequences of contaminated blood cultures. We suggest this to be an initiative to a separate study; to identify the reasons behind the above practice.

Considering the above, we aimed to draw nurse’s attention to the existing hospital blood cultures collection policy and the consequences of poor compliance. According to our guidelines, it was a must to use chlorhexidine to decontaminate the skin, sterile gloves, sterile drapes (figure 2). The nurses were educated throughout the repeated sessions, pocket-held printed cards and stickers applied on kits designated for blood cultures collection. The new process of sterile blood cultures collection was not associated with delays in ED waiting time, which was continuously measured and monitored by other quality officers.

A literature review on contaminated blood cultures in the region is limited. There is only one study conducted by Abdulaziz et. al. in 2015⁶. The study showed the contamination rate of the blood cultures in a university hospital ED in KSA to be around 1.9%, which is already below the benchmark. This highlights the need for more studies and attention to this serious topic in our region. Globally, the contamination rate in many institutions exceeds 7%, thus exceeding the benchmark and institutional quality officers are tackling this issue.⁵

A year after the implementation of our educational campaign, the rate of contaminated blood cultures was still low (around 2%), which represents around 70% reduction from the rate prior to the intervention. This is a great result since the rate decreased despite the fact that new batches of nurses were appointed in response to the increasing demand for hospital staff. The key here was involving the previously educated team in teaching the new members. Additionally, sharing the results on monthly basis and giving positive feedback proved to be an effective approach in sustaining these results. In order to keep sustaining our results, we suggest creating a checklist to monitor the nurses compliance with blood cultures collection policy; which can be used on regular

intervals. In addition to that, refresher sessions can be done at least annually. Furthermore, adopting healthy competitive environment between departments and individuals by rewarding the winners on quarterly basis might be considered.

Although no cost analysis study was conducted to estimate the overall savings that the project resulted in, it is quite obvious that the impact is very significant^{7,8}. The costs of a contaminated blood culture and its consequences on an otherwise healthy patient management is estimated to be at least 4,500 USD per patient in our institute.

A limitation to our project was the inability to measure patients' satisfaction with the new sterile technique. A higher number of attempts of venipuncture might likely be unpleasant to parents and family members.

Further work can be extended to include other departments of our hospital (admission ward, surgical unit, and critical care units), or even hospital wide by the involvement of adult emergency medicine and internal medicine departments.

CONCLUSION

Blood cultures contamination rate was successfully reduced in our pediatrics ED by a simple series of educational sessions to the nursing staff about the aseptic blood cultures collection technique. The intervention was successful in reducing the contamination rate on both short and long-term. Maintaining the rate at the benchmark is a challenge that will require ongoing efforts to monitor and educate the staff about the importance of following the proper technique.

DISCLOSURE:

The authors have no financial interest to declare in relation to the content of this article.

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