Is Repetitive Intraoperative Splash Basin Use a Source of Bacterial Contamination in Total Joint Replacement?

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abstract

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Splash basins are used in arthroplasty cases to wash instruments. Several studies in the literature have shown these basins being a potential source of bacterial infection. This study assesses the risk of contamination of intraoperative splash basins used to wash and store instruments. A total of 46 random clean primary arthroplasty cases (32 hips, 13 knees, and 1 unicompartmental knee) were studied by taking cultures of sterile splash basins as soon as they are opened (controls) and again at wound closure after instruments and debris have come into contact with the sterile water. All cultures were taken with sterile culture swabs and sent to the laboratory for aerobic, anaerobic, and fungal culture. Outcome measured was any positive culture. A total of 92 cultures from 46 cases were tested. Only 1 (2.17%) control culture, which grew *Streptococcus viridans*, was positive for bacterial growth. One of 46 samples (2.17%) taken at wound closure was positive for coagulase-negative *Staphylococcus*. Mean time between basin opening and wound closure was 180±45 minutes. For the 1 infected sample taken at the conclusion of the case, it was 240 minutes. Previous studies show contamination rates as high as 74% for splash basins used intraoperatively. Our study contradicts the belief that splash basins are a high source of infection, with only 2.17% of basins showing contamination. Splash basins can be a potential source of contamination, but the risk is not as high as previously cited in the orthopedic literature.

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Infection control is an important area of research in joint arthroplasty. Surgical site infection following total joint replacement is a multifactorial problem. Deep infection in joint arthroplasty causes significant morbidity in patients, and much work has been done in the past decade to decrease the incidence of this outcome. Several studies exist in the orthopedic literature that examine the operating room environment for bacterial sources of infection that could contaminate an open wound. Among the potential sources of infection are airborne pathogens, operating room staff, and the instruments used during surgery.\(^1\)

The location and time that surgical instruments are opened are related to their risk of contamination.\(^2\) All instruments are opened in operating rooms with clean air systems. However, instruments are exposed for variable amounts of time before a case begins, which affects the risk of contamination. Furthermore, the way instruments are used or cleaned during the case itself may increase the risk of contamination.

During total joint arthroplasty, bloody instruments are commonly washed in sterile water basins, often referred to as "splash basins." These basins are repeatedly used during the case, especially if the case is prolonged. Few studies in the orthopedic literature have looked at these water basins as a possible source of infection. However, one study by Baird et al\(^3\) in 1984 showed that 74% of samples taken from a total of 78 random orthopedic cases grew positive bacterial cultures. Another study by Anto et al\(^4\) observed 21 clean elective hip and knee arthroplasty cases and found that 23.8% (5 cases) of samples yielded positive cultures.

If such a high rate of contamination is possible from instrument rinsing in a sterile basin during total joint surgery, the risk of using such basins in joint arthroplasty surgery needs to be reevaluated to avoid the risk of surgical site infection. The purpose of this study was to examine the sterility of water basins during total hip and knee arthroplasty to assess the risk of this practice for arthroplasty patients.

**MATERIALS AND METHODS**

A series of 46 randomly selected clean primary total joint arthroplasty cases were included in the study. Among the cases were 32 primary hips, 11 primary knees, 1 case of bilateral primary knees, and 1 case of a unicompartmental primary knee arthroplasty. All cases were performed at the NYU Hospital for Joint Diseases in similar operating rooms with laminar air flow systems (300 changes per hour). Operating room personnel were encouraged to use the splash basin in the usual manner during the study period.

Using a culture swab, a sample from each newly opened large plastic splash basin was taken prior to filling it with sterile water. The manner in which the swab was obtained was identical for all samples: large circular motions around the entire basin (Figure 1A). The time the basin was opened was recorded. At the conclusion of the case during wound closure, another sample from the large splash basin used during the case was taken using a culture swab. The basin was cultured using the same technique each time, using large circular motions around the entire basin with a culture swab.

Perioperative data were collected during the case including the time the basin was first opened, the time the patient entered the room, the time of initial incision, the time the first instrument was cleaned in the basin, and time of wound closure (Figure 1B). The culture swabs were identified by numbers only, and no patient data was recorded in this study. Each of the culture swabs was taken to the microbiology laboratory at the institution where the study was conducted and underwent analysis for aerobic, anaerobic, and fungal growth. Organisms were identified by standard techniques. An infected case in this study was defined as having a positive culture when the water basin was swabbed at the time of final wound closure. The initial swabs at opening served as control values.

**RESULTS**

A total of 92 culture samples were taken in 46 cases. The mean duration from the time of sterile basin opening and initial incision was 75±30 minutes and the mean duration of time from when the sterile basin was opened (initial culture taken) to skin closure (time of final culture) was 180±45 minutes (Table).

All of the controls in this study showed no bacterial growth on final culture data except for 1 sample (2.17%) taken before a primary total knee arthroplasty, for which the culture grew *Streptococcus viridans*. The second sample taken during the same case at the time of wound closure was negative for any bacterial growth.

Among the 46 samples taken after wound closure, 1 was positive for coagu-
lase negative *Staphylococcus* (2.17%). This culture was obtained at the conclusion of a unicompartmental knee arthroplasty case, where the total time from basin opening to wound closure was 240 minutes. The rest of the 45 culture samples were finalized as negative for any bacterial or fungal growth at the conclusion of the study.

**DISCUSSION**

A surgical site infection in a total joint replacement results in increased morbidity and cost for both the patient and the hospital. The operating room provides numerous potential sources of contamination, and every effort should be made to identify these sources and minimize them.

Based on previous literature it is believed that using a splash basin in orthopedic surgery is hazardous due to the theoretical risk of infection based on positive cultures obtained from such basins. However, no clinical correlation exists between positive cultures from splash basins and infections following a total joint arthroplasty, and the practice of using them has frequently continued.

Our study contradicts previous studies that splash basins are a high source of infection. Baird et al. demonstrated that among 78 random orthopedic cases, 74% (58 cases) resulted in positive cultures from splash basins. Baird et al. included in their study both infected and clean cases, and interestingly, both had similar rates of positive cultures from the splash basin. Anto et al. looked at clean cases and showed a 23.8% contamination rate of the splash basins; 5 out of 21 basins tested. Our study looked at 46 cases, of which only 1 had a positive culture (2.17%). All the controls were negative except for 1, which we believe was likely a contaminant since the final culture on the same case was found to be negative at the time of wound closure. It is interesting to note that the 1 sample that resulted in a positive culture was taken 240 minutes after the initial opening of the sterile water basin. This is 60 minutes greater than the average amount of time found among all the negative cultures in the study, suggesting that the longer a basin sits out the greater the probability that it may become contaminated (Table). Our data shows that splash basins are probably not as significant a source of bacterial contamination as previously thought in the orthopedic literature.

A major difference between this study’s design and previous studies looking at splash basins is the manner by which samples were collected. Both Baird et al. and Anto et al. obtained 100 mL aliquots of sample and cultured this onto chocolate agar after being run through a membrane grid. Our study used culture swabs. It is possible that using a culture stick on such a large body of water may not be sensitive enough to pick up a positive result. The studies by Baird et al. and Anto et al. both grew a wide variety of organisms including *Pseudomonas*, *Staphylococcus aureus*, *Staphylococcus epidermidis*, *Bacillus* species, gram-negative rods, Diphtheroids, and *Neisseria*. This calls into question whether some or most of these may be contaminants obtained during the culture process. There are no control groups in those studies to compare with final culture results.

We also recorded a lag time between the opening of the sterile basin and the start of the operation. The splash basin exposes a large fluid surface to the operating room environment and acts similar to a large settle plate for contaminants. Chosky et al. has shown that covering instruments after setting them up reduced instrument contamination fourfold, with the benefit achieved most likely from both the shorter exposure time and the shielding effect. The shielding effect is most important during periods of increased activity and risk of bacterial dispersal, such as when the patient is transferred into the room and positioned on the operating room table. This concept explains how a sterile basin can become contaminated during surgery as well.

Our study suggests splash basins are not as high a risk of contamination as previously reported. We had 1 positive culture among the 46 clean cases studied suggesting the possibility that splash basins remain a potential source of bacterial contamination in total joint arthroplasty. Larger studies with patient follow-up would be necessary to determine the true implication of the use of splash basins on infection rates in total joint arthroplasty and surgeons should consider their use carefully when performing arthroplasty procedures and educating operating room staff.

**REFERENCES**


