Power Failure During Knee Arthroplasty

Vinayak Ghanate, Mahesh Kulkarni
Deccan Multispecialty Hardikar Hospital, Pune, Maharashtra, India.

Abstract:

Facing a power failure midst a surgery is a rare event nowadays. But when it happens, it may present as a difficult challenge to operating surgeon, anesthetist and the team. We are reporting one such case event when operating room power outlets failed due to a technical problem midst a total knee arthroplasty. The operating team responded appropriately to the power failure. But response to such event should not necessarily be intuitive. It's important that one must have advanced planning for such events. With this report we aim to shed some light on this topic and serve to facilitate optimal management in such unexpected event.

Key words: Arthroplasty, Electric Power Supplies, Knee Joint, Light, Operating Rooms, Tourniquets.

Introduction

An uninterrupted power supply is a critical resource to hospitals and operating rooms. But, loss of power in hospitals is a patient safety hazard that has been neglected in our medical training and research [1,2]. Nowadays, in the technically advanced operating rooms, sudden power failure puts patient's life at risk, as lights and other critical equipment's may fail without warning. Such events amidst surgery may not only put patient's life in danger but also present a formidable challenge to the operating team.

Case Report

In middle of the day our team was operating a case of bilateral total knee arthroplasty of a 60 year old female. Patient did not have any medical co-morbidities and was ASA grade II, and put on spinal anesthesia. Electrically controlled pneumatic tourniquets were applied to both lower limbs. After routine preparation and painting draping, tourniquet for first limb elevated after exsanguination.

The surgery was progressing smoothly, when the overhead procedure lights suddenly flickered and went off due to loss of power. The only light coming in operation theatre (OT) was that of anesthesia monitors, which were running on the self-battery backup. As the patient was not under general anesthesia or on any ventilation support, concern of immediate risk to life due to loss of critical anesthesia machines was not there. The vitals stability of patient was confirmed with the anesthetist. The first call was given to get some source of light to assess the situation. A small torch

Corresponding Author: Dr. Vinayak D. Ghanate
Email: vinayak.d.ghanate@gmail.com
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light, which was in OT turned on. The last time noted by everyone on tourniquet machine was 22 minutes. The electrical tourniquet machine after sudden shut down didn't release the tourniquet pressure and the tourniquet was well maintained. The time in the anesthesia monitor clock was noted to keep count of tourniquet time. The circulating nursing staff in OT was requested to find out the reason for power failure.

The source of light from torch was too feeble to continue with the procedure. So, surgical wound was covered with wet saline mops to avoid tissue drying and covered with a sterile drape to avoid any contamination. The vitals stability of patient was again confirmed with anesthetist and also confirmed about the manual check on vital parameters like pulse, BP, respiration. The circulating staff came with the answer that, there is been a technical failure of the relay of electrical switch of the operating complex. In spite of having the uninterrupted power supply system to hospital, the electrical generator back up was unable to deliver electricity in operating room complex. We summoned the electrical engineer to resolve the problem.

At this point in surgery, the time line for the restoration of power was unpredictable, therefore it was uncertain when the procedure would be completed. And the procedure was midst at a point where major bone cuts were completed, so abandoning procedure and doing it at later time was not in question. As patient was under tourniquet, it was crucial to restart the procedure early. But another better light source was not available. It was 15 minutes after the power loss when the electrical engineer came in operative complex changing to sterile OT cloths. After assessing the switch board, he confirmed that he could manually switch and start the power supply to operative complex. To do so, he needed 10-15 minutes of time. So we continued to keep watch on patient's vitals and wait till power supply was restored.

The electrical power supply was restored after total time of 30 minutes. Overhead light source started, cautery, tourniquet and other machines started again. This time we feared that the tourniquet machine may release the cuff pressure, as nobody knew the exact response from that particular tourniquet machine in such situation. So we kept the wound compressed with mops by hand to decrease sudden gush of bleeding in case of tourniquet cuff release. The machine restarted and maintained the pressure, but the tourniquet time started again from zero. After adding the power loss time of 30 minutes we had actually used total of 52 minutes tourniquet time till now.

Everyone changed to new pair of gloves and procedure restarted. After some time we noticed that the operating rooms temperature was not cooling down. Again circulating nursing staff was requested to check with electrical engineer. It was found that he restored only the emergency power supply as first priority. The full power supply and the air conditioning will take some more time to restore. Now, we knew that, we may have to do cementing at this high temperature only, so we were prepared for the short working cement time.

Next procedure went smoothly till we reached cementing of components. First tibial base plate was cemented over tibial cut surface. We were about to put femoral component but unfortunately the power supply failed again. But this time we were in crunch situation, and racing against time for cementing in already high temperature of operating room. Left with no other choice, the emergency torch light switched on and in that feeble light the femoral component was placed and fixed.

The power supply was restored within 1 minute. This time the full power supply started. We got to know that the 1 minute power loss, was by engineer, who switched it to full power supply. Tourniquet released at 20 minutes of the new time, so

total tourniquet time was 72 minutes. The hemostasis was achieved and vital stability confirmed with anesthetist. As the patient was under only spinal anesthesia, proceeding with opposite side knee was discussed and combined decision taken to proceed with opposite side knee replacement. Opposite side surgery was completed smoothly without any hurdle, in tourniquet time of 40 minutes and within the spinal anesthesia time. Total tourniquet time including for both side was within the prescribed guidelines for lower extremities [3-5].

Appropriate antibiotics were started and close watch kept over patient's parameters post-operatively. Patient discharged on 4th post-operative day after achieving all routine knee arthroplasty physiotherapy protocols. Sutures removed on 12th post-operative day in outpatient follow up. Rest of the recovery was uneventful.

Discussion

Operating room power failure is a critical event which requires advance preparedness. Hospitals should be subjected to rigorous regulations regarding emergency generator power testing and reliability, and required to develop plans for power failure emergencies [6]. The most valuable contribution anyone can make in such situation is to maintain his or her calm composure. The operating surgeon and anesthetist both play crucial role in managing such crisis situation. Calm and controlled tone, confident, short and simple directives, clear communication, mutual discussion and decisions are the key points in handling such situations.

In our case, fortunately it was middle of the day so electrical engineer and other technical staff were available to deal with the sudden technical failure. Availability of good battery operated emergency light source would have decreased the tourniquet burden over the limb. Behavior of tourniquet machine in such situation should have been known beforehand. The second loss of power for 1 minute should have been planned by the engineer after confirming with the operating team.

Few recommendations based on our experience in managing power failures in OT are: (i) Be prepared, check batteries, keep emergency flashlights, suspend surgery, and call for assistance, (ii) maintain ventilation, monitor vitals, (iii) routine checkup of anesthesia machinery, (iv) use tourniquet machines which maintain pressure even in sudden power failures, (v) keep count of time for tourniquet and anesthesia time. (vi) take mutual decisions to plan whether to continue or abort the procedure depending on patient stability, power reliability and remaining anesthesia/surgery time, (vii) arrange mock drills to handle such situations, (viii) set standards for emergency electrical power systems should be implemented while building operating rooms [7-9], (ix) Remember to remain calm and in control with clear communication.

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