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The Importance of Surgical Lights

Interview with Prof. Dr. Axel S. Merseburger, Director of Urology at UKSH, Lübeck

Dräger

Technology for Life

Conducting surgeries demands a maximum of focus and precision skills of the surgical team during all performed activities. A vital instrument to support these activities is the illumination of the wound field. It needs to fulfill outstanding requirements in terms of functionality, quality and safety. Axel Merseburger, professor of urology working at the university hospital Schleswig-Holstein based in Lübeck and chairman of the Department of Urology, gave an enthusiastic and enlightening interview on the importance of surgical lights in the operating theatre. While surgical lights often just belong to the infrastructure of an operating theatre in the minds of the OR personnel, he points out that they are far more than that, and that it's worthwhile to pay more attention to purchasing high-quality lights.

Prof. Dr. Axel S. Merseburger, Director of Urology at UKSH, Lübeck

Challenges in the Operating Theatre

The operating theatre is typically a high-stress environment, with tight schedules, harsh conditions, e.g. lack of natural daylight, and very complex processes. Furthermore, operating theatres are the cost driver and profit earner at the same time for hospitals, therefore streamlined workflows as well as modern technologies supporting these workflows are essential. Personnel working in operating theatres have to bear high workloads and stressful situations due to ever-changing situations and sudden emergencies on the one hand, and severe cost pressure on the other.

Apart from that, the operating theatre faces additional challenges, which OR personnel need to deal with: The most obvious one is keeping a sterile environment: "Maintaining a sterile environment is crucial for the safety of patients, but also for the personnel." According to the WHO global IPC report 7% of hospitalised patients in high-income and 15% in middle-income countries will acquire at least one health care-associated infection.[1] Nosocomial infections need to be prevented, since complications would mean longer hospital stays for patients and thus less turnover for the hospital.

Teamwork and communication are a soft factor but not less determining: As **Prof. Merseburger** points out "We have to communicate, we are a team, and in teamwork it is always very important to communicate with all the members of the OR staff in the operating theatre, the anaesthesiologist, the staff nurses, the doctors, the surgeons." As in all complex environments seamless workflows become more essential, and having a clearly organised interaction between all members of the OR personnel is even more vital. Above all, proper communication in the case of adverse events becomes critical: "We have to deal with emergencies in the OR: unexpected bleedings, unexpected situations, e.g. cardiac arrests, which gives very sudden situations where we all have to work like a good-working machine. And since we are all humans in the operating theatre, communication is very crucial for the safety of our patients but also to have a safe environment for the personnel."

Additionally, complex technological surroundings are straining OR personnel's work life. "I think it's also essential to look at the technology we are dealing with and the equipment. Here, knowledge about the technology and technical equipment is very important. Because, as we know from private life, we all need to know how the coffee machine works, otherwise it's frustrating, and this is much more important in the example of an operating theatre, where everybody needs to know how a machine, how a device, how a lamp, how a robot works, in order to have a good workflow in the OR."

So in conclusion, all these challenges require very careful planning as Prof. Merseburger remarks, so that communication and clinical workflows run smoothly throughout the day.

Significance of surgical lighting

But why is surgical light so important in the OR? As stated in an analysis for better surgical lighting, "surgeons and assistants who have visual problems can make serious mistakes."[2] That is underlined by Prof. Merseburger with several arguments: "A well-designed and properly positioned surgical light can enhance the surgery and provide more safety for the team and therefore also for the patient. The lighting can enhance

the accuracy and precision of the surgical team's movements and thus help to reduce the risk of errors and complications. Additionally, proper lighting can reduce eye strain and fatigue among the surgical team, which can be a significant issue during long surgeries." In that context, it's extremely important to reduce glare effects, occurring when there is a big difference between the surrounding light and the light on the wound field[3], leading to eye fatigue. "By reducing the amount of visual strain, the surgical light can help the surgical team to maintain focus and concentration, which can improve the quality of the surgery." Obviously, surgical lights are far more than just infrastructure. Delivering high-quality light and featuring the right attributes, can ease surgical procedures and help the surgeon conduct the surgery more safely. In fact, there are some features which a surgical light must have in order to be conducive for the surgeon.

Demands on surgical lighting systems

"One is the adjustability: You need to move the light towards a specific area of the body in the field you are operating in." For better ergonomics in the OR, this requires an easy reach and adjustment to the desired position without having to strain or stretch. "Adjustable brightness is also an important factor, as well as the colour of the light: it should not be too light, nor too dark, it needs to be a warm colour."

"Besides, the heat prevention: If you are working in an OR environment, you move a lot. You are wrapped with your sterile equipment, and the patient is heated, so additional heat should also be avoided." As well, when using two or more light heads, heat transfer from the light heads to the surgical cavity can be an issue. The light intensity on the patient should be kept to a minimum in order to prevent possible drying of the wound field[4].

As already mentioned, "Sterility is something we deal with every day, and so the surgical lights need to be cleaned easily by the cleaning personnel. And on the other hand, they need to be operated easily, with e.g. sterile cuffs to move, because we as surgeons need to touch the light in order to adjust it."

"Moreover, shadow reduction helps a lot. If we have shadows, it's hard to differentiate the tissue planes. So this is something which helps us surgeons, to have clear-cut light without a lot of shadows." Adjusting the light is a form of distraction, interrupting the surgery every time and thus prolonging it unnecessarily. A recent study found out that every 7.5 minutes a luminaire action needs to take place, intended to reposition the light head.[5] That leads to the conclusion that these interactions should be reduced to a minimum. "Surgical lights may also have features that automatically adjust the lighting based on the surgical field's characteristics. For example, some lights may use sensors to detect the position of the surgical team's hands and automatically adjust the lighting to reduce shadows and improve visibility."

Another point is that in complex and highly technological environments, where adverse events are to be avoided, intuitive and user-friendly devices are helpful to reduce the risk of human errors[6]. "Overall, intuitive control of surgical lights is an essential feature that can help the surgical team to conduct the procedure more easily and safely, improving workflow efficiency and surgical precision. The surgical light's control interface should be designed to be user-friendly and responsive, allowing the surgical team to adjust the lighting without disrupting the surgical workflow."

In modern operating theatres it's also necessary to install imaging technology, as to have a bigger and more precise view of the surgical cavity, but also for documentation purposes. "Besides, including a camera and transferring the image to a monitor might make sense for educational purposes."

Future requirements

Taking a look into the future, what are the requirements that would make the surgeons' life even more comfortable? "With advancements in AI technology, surgical lights could potentially be equipped with AI capabilities that can automatically adjust the lighting based on the specific needs of the procedure. This could help to reduce errors and improve workflow efficacy in the operating theatre. Another point: Wireless control. Currently, surgical lights are typically controlled via a wired connection or by hand manually. In the future, surgical lights could potentially be controlled wirelessly, without anyone touching them. Lastly, improved energy efficiency: Surgical lights typically consume a lot of energy. In the future, surgical lights could potentially be designed to be more energy-efficient, reducing their environmental impact and operating costs. Overall, the features of a surgical light will continue to evolve as technology advances, with a focus on improving workflow efficiency, surgical precision, and patient safety."

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