WTC2023

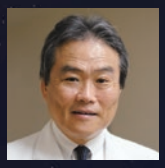
The 6th World Trauma Congress

Luncheon Seminar 4

Innovation to Illumination During Trauma Surgery in USA, India, and Japan

新たな光で見える　アメリカ、インド、日本の外傷外科

The 6th World Trauma Congress was held in Tokyo from August 9th to 12th.
This paper shows excerpts from Luncheon Seminar 4 titled "Innovation to Illumination During Trauma Surgery in USA, India, and Japan" hosted by Taiyo Corporation.
Taiyo Corporation developed the OPELAIII, wearable surgical lighting system.
3 speakers presented their experiences using the system, its advantages, and its application in clinical settings.



Moderator

Dr. Yasuhiro Otomo

Superintendent, Disaster Medical Center,
National Hospital Organization

LS4-1

Emergency Trauma Operations in the Modern Era: Breaking the Myths

Dr. Kazuhide Matsushima

Associate Professor of Clinical Surgery, Surgical Critical Care,
University of Southern California Keck School of Medicine, USA

LS4-2

Mobile Illumination Adjuncts for Emergency and Trauma Surgeons: A Boon in Low Resource and Austere Environs

Dr. Amit Gupta

Professor of Surgery, Division of Trauma Surgery & Critical Care,
JPN Apex Trauma Centre, AIIMS, New Delhi, India

LS4-3

Usefulness of OPELAIII in the scene of ER and disaster

Dr. Tomohisa Shoko

Department of Emergency and Critical Care Medicine,
Tokyo Women's Medical University Adachi Medical Center

TAIYO Corporation

Wearable Surgical Lighting System

OPELA III™

LS4-1 Emergency Trauma Operations in the Modern Era: Breaking the Myths

Dr. Kazuhide Matsushima
Associate Professor of Clinical Surgery, Surgical Critical Care, University of Southern California Keck School of Medicine, USA

Today my talk is about emergency trauma operations. The standard care in trauma includes damage control surgery. It focuses on control of hemorrhage (packing) and contamination (resection). When we perform trauma emergency laparotomy for intra-abdominal hemorrhage, we were taught to start with four-quadrant abdominal packing. However, a single institution study at our institution over 2015-2019 indicates only 15% of patients required four-quadrant packing in theory. The rest of the study patients only required direct packing, meaning a certain area in abdominal cavity needs to be packed or no packing was necessary. In gunshot wounds (GSW) patient, it's more difficult to predict what kind of intra-abdominal injuries are causing hemorrhage. But still, oftentimes you can just perform a direct packing.

Another component of a damage control surgery is rapid control of contamination mainly from hollow viscus injuries. Oftentimes we quickly resect a segment of injured hollow viscus and don't perform anastomosis and leave the segment at discontinuity. We then bring the patient back to the OR for a second look. Another single center study from our institution included patients who underwent damage control surgery with a colon resection. In this study, almost 70% of the patients underwent primary anastomosis during initial surgery. And if you include the second and third look, almost 90% of patient ended up undergoing a primary anastomosis for destructive colon injuries. Only 2% of the patient underwent some sort of fecal diversion, such as colostomy or ileostomy. And the incidence of anastomotic leak was 11%.

Fig.1 is a case of a patient who had GSW with a diaphragm injury, and in such cases routine use of a surgical retractor is useful. But still some area in abdominal cavity is very difficult to expose even with adequate instruments.

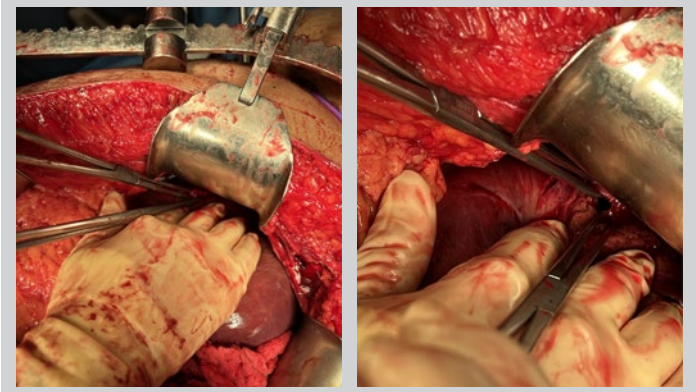


Fig.1 Retractor use in GSW case with a diaphragm injury

That's why we have our trainees wear surgical headlight almost routinely in these type of trauma cases. **Fig2A** is exactly what I am seeing without any surgical headlight. It's hard to tell which structure is what. But if you wear the portable surgical headlight (OPELA Ⅲ), it's very clear in terms of anatomy of a very dense area. **Fig.2B** is the case I performed the pancreaticoduodenectomy and you can see the conference of the splenic vein and the portal vein as well.

Even in a hospital like trauma centers, nowadays acute care surgeon performs surgical procedures in an area considered austere settings, such as bedside in ICU. In such cases sometimes the OR team needs to bring instruments to ICU. However, the room light is not enough to expose the surgical field.

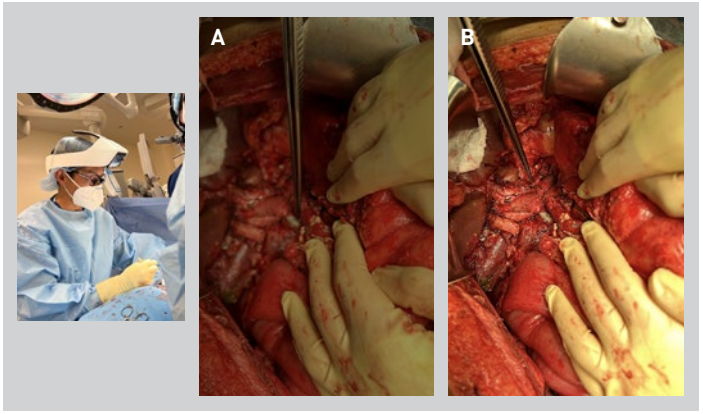


Fig.2 Pancreatectomy with and without headlight

Fig.3 is the photo of our residents performing resuscitative thoracotomy. The exposure during an emergency room thoracotomy is often not ideal. Because again due to limited light source the structures in the chest area is very difficult to expose. As you can see in the picture, the surgical field is very bright just because the residents are wearing a portable headlight. And I was very impressed by how brightly the surgical field was illuminated when we had our resident wear a portable headlight. Before then, we didn't routinely have a resident wear the headlight. But after that, we always ask the resident to wear the headlight in case we get a page from prehospital providers for cardiac arrest after trauma or unstable patient, so that if we need to perform resuscitative thoracotomy, we get a good exposure of the left chest.

In summary, I'd like to encourage all trauma surgeons and trainees to think about what we could do differently to improve the quality of our trauma emergency operations. And I would like to ask all the people to challenge the current dogma in their trauma care, so that we can use appropriate resources which are available and then improve the patient outcome.

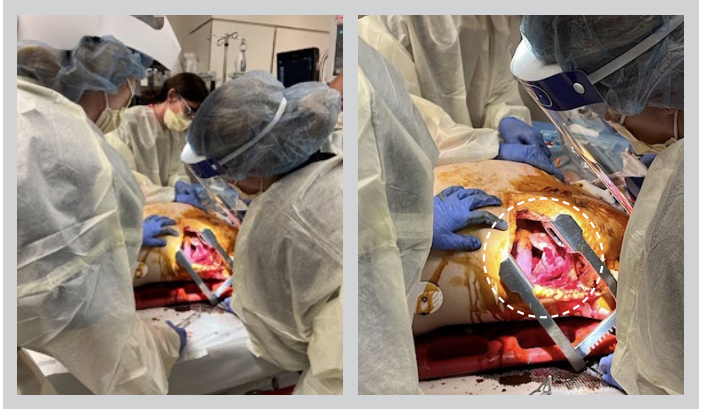


Fig.3 Tracheostomy with OPELA III

LS4-2 Mobile Illumination Adjuncts for Emergency and Trauma Surgeons: A Boon in Low Resource and Austere Environs

Dr. Amit Gupta
Professor of Surgery, Division of Trauma Surgery & Critical Care, JPN Apex Trauma Centre, AIIMS, New Delhi, India

The publication by World Health Organization called "Surgical Care at the District Hospital" said that operating room essentials must include not only dedicated equipment for procedures and patient monitoring equipment, but also good lighting or surgical illumination.

These are basically the five attributes which a good OR lighting system should have **(Fig.4)**. It should be bright. It should be neutral, or I would say the color of the light should be natural. It should be shadowless so that your hands or other things do not come in between, and even if they do, they do not obstruct the lighting from affecting the surgical field.

It should also have a depth of lighting. That means there should be multiple sources of light or multiple lights, giving an impression of three dimensions. And also it should be safe to vision.

The organization, which actually gives credibility to these factors, is known as the International Electrotechnical Commission (IEC), which has a code IEC 60601-2-41.

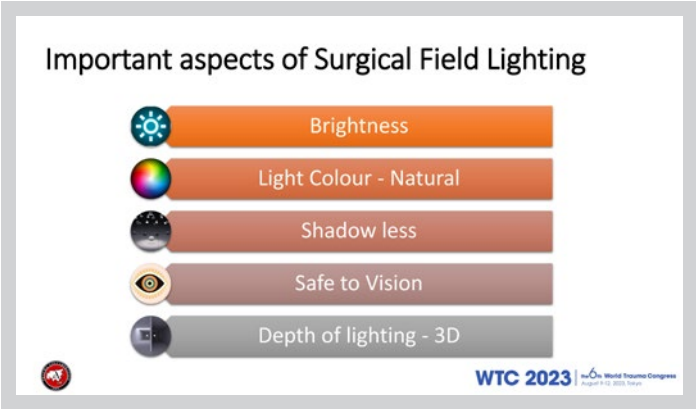


Fig.4 5 important aspects of surgical light

It has laid down certain basic necessities for a good surgical illumination, such as brightness or what should be the proper color in objective terms. How to define a shadowless effect. What it means to be safe to vision. What are the parameters and what should be the ideal depth of lighting. I won't go into the details, it's all available on the internet. In short, we have a sort of international standard for surgical lighting and illumination. So whatever light be, it should actually adhere to these international norms or standards.

OR illumination in low resource settings could be augmentation of the current OR light which is already there in the OR. That means you already have light, but it may be insufficient.

Oftentimes, during surgery you have to move the OR light every time it does not show the depth of field and you, the surgeon, is struggling to adjust the light in order to reach the intended surgical field.

So it could be for augmentation of existing OR light or in austere circumstances like disasters and field hospitals, it might be the only sole light source and therefore it needs to be easy to carry, it needs to be mobile, it needs to be bright **(Fig.5)**. And all those attributes which I just said should be there in that light.

And so what's the answer? The answer probably is a light on the surgeon's head, which was shown by the previous speaker, Dr. Matsushima.

Fig.5 Insufficient lighting in disasters and austere environs

So if the surgeon has a light on his head, obviously wherever he is moving his head, the light would go there. But it has to have the basic tenets set by the IEC standards. And that's probably one of the answers for austere circumstances **(Fig.6)**.

Fig.6 Ideal mobile illumination

It can be a solitary surgical headlight. It could augment the poor surgical lighting in rural and district level hospitals. And therefore, according to me, apart from the brightness, depth of vision or 3D vision, it has to be easy to carry and mobile and also has to have a self-sustaining part because in many of the conditions we see, either there's no electricity in these rural areas or there's a very frequent electrical breakdown or power outage. Therefore, we should remember that these lights should be self-sustainable in terms of the power as well.

As a trauma surgeon, I wish to also capture what I'm doing live. So in development of new surgical lighting system, I wish it could be integrated with a camera system. This way, not only will you have good illumination but also record your procedures.

Majority of injuries fall under the categories of transport related, unintentional (falls, animal injuries, etc.), intentional self-harm, interpersonal violence, workplace injuries, and natural disaster. But morbidity and mortality are preventable if health care infrastructure can be improved. And surgical illumination is a very important part of augmenting the surgical infrastructure especially in the global south in area of trauma and critical care.

LS4-3 Usefulness of OPELAIII in the scene of ER and disaster

Dr. Tomohisa Shoko
Department of Emergency and Critical Care Medicine, Tokyo Women's Medical University Adachi Medical Center

Today, I would like to talk about OPELAⅢ, a new headlight used in emergency, critical care, trauma surgery and disaster medicine settings.

In the first part of my presentation, I will describe the usefulness of OPELAⅢ in our Emergency Department (ED) and its features. The surgical light in our hospital ED is a normal ceiling-mounted lighting with 2 arms. But the light sometimes does not reach the surgical field I want to see. During emergency operation with limited personnel, it is not easy for circulating nurse to accurately direct the light from the ceiling light onto the surgical field. Which, honestly speaking, can be very stressful in emergency operations. In those times, not only can OPELAⅢ illuminate entire surgical field without moving the ceiling light, but also ensure subsequent brightness in the place the surgeon most want to see. So, in order to use OPELAⅢ headlight effectively during emergency, we think it is important to familiarize oneself and use it regularly in emergency situations.

A standard operating light illuminates wide area. However, when operating in deep area, surgical field can change frequently so we need to adjust the center position and the focus of light accordingly. Conventional surgical headlight can illuminate deep narrow surgical field, but the surrounding remains dark. If using these types of headlights only, it is difficult for us to perform emergency surgery. Whereas, light from the OPELAⅢ can reach deep and narrow surgical field while also illuminate the surroundings **(Fig.7)**.

OPELAⅢ functions as both OR light and headlight at the same time. By using this simple light, we can easily achieve both of these functions during surgery.

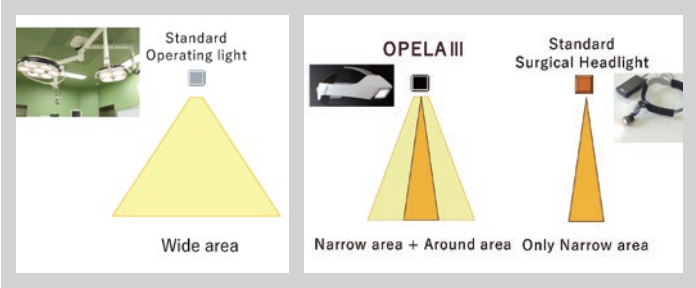


Fig.7 Comparison of 3 medical light

In the second part of my presentation, I will explain the benefits of OPELAⅢ in the ICU.

During intensive care, there is the risk in moving patients to operating room. So almost all tracheostomy is done in the ICU with the patient connected to a ventilator, dialysis machine or other medical devices.

We previously performed tracheostomy with the use of mobile surgical light but since it is set up between medical devices around the bed with limited space, it can interfere with other medical devices. It is also difficult to accurately position the surgical light and if it is behind the surgeon's head, it can result in the formation of light and dark areas.

Now using the OPELAⅢ wearable surgical light, we can perform tracheostomy with bright surgical field and the staffs no longer have to go to trouble of bringing mobile surgical light. It is extremely useful in terms of both providing sufficient lighting and ease of preparation in urgent surgery.

In the final part of my presentation, I will describe how effective OPELAⅢ is in disaster situations.

I participated in the International Disaster Relief Team of JICA (Japan International Cooperation Agency) to provide support treating earthquake victims in Nepal several years ago. And I performed the surgery inside field tent hospital.

I remember how difficult it was to bring in large heavy OR light and having to assemble them.

In February 2023, JDR (Japan Disaster Relief) team was dispatched during the earthquake disaster in Turkey. The OPELAⅢ was used again in the operating room of a field tent hospital erected on site **(Fig.8)**.

I was not there but I heard from the surgeon doing open surgery on fracture of a hand that there was sufficient brightness with OPELAⅢ alone. Being lightweight with high intensity light and battery operated, OPELAⅢ effectively demonstrated its value during surgery even in disaster area.

Fig.8 Field hospital overseas

We hold emergency preparedness training drills several times a year, simulating NBC (nuclear, biological, chemical weapons) disaster.

We developed a special emergency vehicle especially for an NBC disaster to be used as temporary operating room where hemostasis and other lifesaving procedures can be performed. And OR light is one of the most important pieces of equipment during surgery. However, it became apparent that due to its large size, it cannot fit in the vehicle. Even if we managed to fit one in, adjusting its angle and position would be extremely difficult. OPELAⅢ is small and bright enough to perform open surgery. So if there are 2 of them available, even complex surgical procedures can be done in an ambulance even without ceiling OR light **(Fig.9)**.

We believe that wearing OPLEAⅢ regularly in clinical practice, can help with brightness of the surgical field but also help prepare for emergencies and disasters.

Fig.9 Surgical training using 2 OPELA III in ambulance