

Observations on Performing Neurosurgery in the Time of War in Ukraine

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War is hell, and providing far-forward neurosurgical care is extremely challenging.

In December 2024, I (author DK) visited Mechnikov Hospital in Dnipro, Ukraine – the front-line medical center 100 km from the front. I was the guest of Andrii Sirko, Academic Chair of the Neurosurgery Department. For three days, Dr Sirko kindly allowed me to shadow him.



In the photo, Prof Sirko is studying the CT scan of a wounded soldier's brain. The desk is decorated with a memorial to the combat medic, presented to him by Prof Rocco Armonda, Georgetown University.

Mechnikov Hospital, one of the largest in Ukraine, is one of two Ukrainian trauma hospitals. It has 1,700 beds, three emergency ORs, 22 elective ORs, six intensive care units with 160 beds, and three neurosurgical departments with 120 beds.

While already operating at capacity prior to the war beginning in April 2014, the hospital has learned to be creative and accommodate new patients when the hospital began receiving military and civilian war trauma casualties from all of eastern Ukraine.

Dr Sirko's day starts with three meetings: first with his team to discuss the patients received and treated overnight; second with all department chairs and upper administrators to address issues with potential impact on individual departments and overall hospital operations; third with his day team to discuss the coming day's work. The pressure caused by having to accommodate a large number of new patients each day means each meeting is as brief as possible. Rounds in three intensive care units are next, followed by Dr Sirko commonly performing two or three surgeries per day. Surgery is followed by consultations with new patients.

Dr Sirko and his team have a high rate of excellent patient outcomes in treating wartime trauma patients. The pressure and limitations of equipment, electricity, and materials forced them to develop new approaches and techniques. Because of his vast knowledge and experience, Dr Sirko is frequently asked to give virtual presentations on improving trauma outcomes, especially following mass casualty events. He is an excellent and patient teacher, e.g. his group has weekly virtual consultations with international outside neurosurgical experts to allow his residents and staff to discuss complicated neurosurgery cases.

Patient treatment

Since the start of the war in 2014 until December 2024, the hospital has received 38,659 wounded soldiers and civilians, requiring from 1 to 8 neurosurgery operations daily. Of these, 2,095 have had penetrating TBI. Injured soldiers are stabilized close to the front line, then transferred to a mobile military hospital, and as soon as possible to Mechnikov Hospital. In the earlier days of the war, time from injury to hospitalization was relatively fast due to the use of

helicopters. That is no longer possible due to the unacceptable risk of being shot down. Transport is now by road, which typically takes at least three hours, resulting in the injured arriving at the hospital about five hours after injury.

CT scanners are now located far forward to the battlefield, with CT images and other diagnostic information transmitted to the hospital. This significantly reduced the time between patient's hospital arrival and beginning appropriate treatment. This has contributed to Mechnikov Hospital having an exceptionally high survival rate for the victims of war, about 95%.

Massive numbers of patient arrivals

The policy at Mechnikov Hospital is that surgery should begin within 2 hours of hospital arrival: treatment of vascular injuries, followed by early surgical treatment of TBI, and concurrent repair of damage to the skull base, paranasal sinuses, and dural venous sinuses. Meeting this timeframe is very challenging because mass casualty events (injury to 10 or more individuals), are common, with the hospital often receiving up to 50 new patients per day.

I (DK) was present for the simultaneous delivery of 10 patients: the event was striking because the corridors were quiet, calm, and orderly – essential features for determining patient treatment options and priorities and initiating interventions. Daily the hospital receives war-related military and civilian trauma patients, along with the ongoing arrival of civilian patients with non-war-induced ailments, diseases, traumas, and cancers, both life- and not imminently life-threatening problems. Presently, about 30% of the hospital beds are occupied by soldiers.

While war-related life-threatening traumas receive priority treatment, oncology and other conditions often require urgent care that cannot be delayed by more than a day. One of Dr Sirko's mottos is to leave no one out and save every life possible. Coping with the constant inflow of patients also requires making beds available. Patients who normally would be kept in the hospital for a week or more are moved to other hospitals in Ukraine within 2 to 3 days.

Facilities



Mechnikov Hospital neurosurgical ORs are generally well-equipped and have a rapid turnaround time. However, the surgical demand is greater than normal OR use allows, resulting in multiple surgeries being performed simultaneously in some ORs, as the photo shows. Similarly, space limitation necessitates keeping some patients in beds in corridors.

Staffing

The neurosurgery department staff is excellent: some of Dr Sirko's OR team, such as his anesthesiologist and scrub nurses, have worked together for more than 15 years. This also results in a peaceful and relaxed OR environment, in which humor often erupts – reducing the stress of a high surgical intervention volume.



First row scrubbed in (L to R): Karina Kubinets, operating nurse, Andrii Sirko, neurosurgeon, Vadim Botykov, assistant surgeon.

Second row: Anna Gridneva, nurse, Damien Kuffler, neuroscience professor, Petro Golota, anesthesiologist. Photo courtesy of Dr Rostislav Maliy, neurosurgery resident.

The Neurosurgery Department functions remarkably well despite working under enormous stress. The stress is not only performing many operations per day but also because no one has had a vacation since the war began, and the work is being performed under constant blaring of sirens warning of potential attacks. There is also the anxiety about the well-being of their family members and friends, while remaining in the hospital without any way of assisting them. The psychological toll is high but no one speaks about it because that would not help – they must continue their tireless tasks with no end in sight.

There is also stress caused by understaffing. At least one-third of the neurosurgery staff has left the hospital because of being mobilized, leaving Ukraine, and moving to safer hospitals in Ukraine. The department must now deal with more than a 30% increase in patients but a 30% decrease in neurosurgeons.

What is needed is a doubling of the neurosurgery staff, which will not happen. There is no complaining, and Dr Sirko's humor and determination keep everyone well focused. Everyone knows that if they do not maintain this ceaseless pace, loss of life or limb of a brother, sister, friend, or stranger will result.

Immediate physical dangers

While Mechnikov Hospital has not suffered a direct hit, a close strike on October 25, 2024, blew out at least 460 windows, many doors, and damaged surgical equipment. That close hit also blew out the windows of an OR during brain surgery. Fortunately, none of the staff or the patient were affected. As is typical in Ukraine throughout this war, immediately after each attack everything is cleaned, stabilized, and life moves forward.

Burnout

Life in a war zone is exhausting, but keeping a good face helps. I (DK) saw plenty of joy, humor, and life in people's faces in the streets, markets, restaurants, and the hospital. However, I also saw a lot of suffering, such as when people let their guard down or were asked personal



Photo: Morning rounds at the combat block, neuroresuscitation department, where the windows broken during the rocket attack are temporarily closed by chipboard – called “wooden windows”.

questions about the war. Everyone knows directly, or through a friend, someone who has been injured or killed. There is also the great strain of having friends or family members fighting on the front lines. The challenge is also increased because, once a person is called up, they cannot leave for the duration of the war, and if injured, once patched up, you return to the front.

Overseeing three neurosurgery departments, Dr. Sirko works tirelessly. During his “off” hours, he has published 15 papers this year alone on war surgery in Ukraine. Many of the findings will be included in the Brain Trauma Foundation Guidelines for the Management of Penetrating Traumatic Brain Injury.

Other hospital department heads, e.g. Sergii Grygoruk, Dmytro Ovcharenko, Andrii Miroshnychenko and Yurii Cherendynchenko, work side by side with Dr Sirko every day. He has also received enormous assistance from neurosurgeons outside Ukraine who have come and performed neurosurgery. Among these are Rocco Armonda, Alex Valadka, Luke Tomych, Gregory Hawryluk, Connor Berlin, Alex Razumovsky, Keen Green, Kim Wright, Maksim Shapiro, and Kim Nelson. International cooperation was successfully organized by the Razom Co-Pilot Project from the Razom for Ukraine organization.

Conclusions

Despite the horrible conditions inflicted on Ukraine since 2014, and working in a hospital 100 km from the front, with insufficient neurosurgical staff and equipment limitations, Dr Sirko and his colleagues work patiently, doggedly, with humor, forcefulness, tirelessness, and determination to provide superb neurosurgery care with a remarkable success rate for a non-stop flow of military personnel and civilians. No one is left out. Dr Sirko still occasionally performs a few dance moves in the OR! He continues to train residents, has overseen faculty getting advanced degrees, and has published many papers in high-impact journals.

Ukraine deserves all the support we can provide.