

Invited Review article

Management Issues with Infection Control during Trauma Resuscitation in the Era of COVID-19: South African Experience.

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Abstract:

Background: This invited short report aims to document the management of trauma and non-trauma ICU patients in one quaternary facility in South Africa during the first two waves of the SARS CoV2 (Covid-19) pandemic in Kwa Zulu-Natal. **Content:** The setting of the trauma service and the changes made to ensure staff and patient safety are detailed. A brief overview of the clinical experience of caring for both trauma and non-trauma cases is provided along with the management of those cases who were found to be Covid-19 positive. The concerning aspect of increased antibiotic resistance development and the potential roles of antiseptic sanitisers is briefly discussed. **Conclusion:** Trauma care is essential during the infectious pandemic and there is a risk of increased antibiotic resistance. Doing the basics “right” can prevent staff contamination or adverse patient outcomes.

Keywords: Trauma; infection control; antimicrobial resistance; Covid-19; prevention management.

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Background

Trauma is the fourth burden of disease in South Africa along with non-communicable disease, infections and maternal-child-health.¹ Compared to many other high-income and even many lower-and-middle-income countries the trauma rates in South Africa are among the highest in the world, with a large penetrating trauma burden, not seen in other African countries without engaging in civil unrest.² In the context of this high trauma burden is the challenge of limited trauma care facilities in a resource-constrained country, particularly in terms of intensive care facilities³. In this resource-challenged

environment up to now good antibiotic stewardship and surveillance have ensured effective control of antibiotic resistance in the local trauma environment within KwaZulu-Natal.⁴

In light of this background, the ongoing world-wide pandemic known as the SARS2-Cov or COVID-19 hit South Africa in March of 2020^[5], causing many infections, whether symptomatic or not, and creating fear and distrust in the medical community, especially in the public sector. This needed a change in the approaches to how, trauma patients in general, and trauma intensive care admissions in particular were managed.

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This short-report aims to describe the response of the Trauma ICU at Inkosi Albert Luthuli Central Hospital (IALCH) as part of the hospital-wide disaster activation and to specifically give insights into the aspects of infection-control and some antibiotic resistance patterns noted during the past 15 months during the South African pandemic. The experiences of the surgeon-intensivists who manage major trauma referrals to the Trauma ICU are outlined, and some data collected in the Trauma Registry is provided for illustrative purposes. All research within the unit is performed under the auspices of an Ethics Approval by the UKZN-BREC committee, BCA207-09, for retrospective and non-interventional studies.

Inkosi Albert Luthuli Central Hospital is a national referral centre for complex diseases and one of approximately ten similar facilities across South Africa, a country with a population of over 55 million people. During the pandemic the hospital Joint Operations Command directed overall hospital management and the Trauma ICU was designated as the Covid “negative” ICU, with 8 ICU and 6 high-dependency beds, while the main general ICU was designated as the Covid-19 ICU, with 20 beds. The unit still received trauma referrals for ICU from surrounding facilities and directly from the emergency medical services, while also absorbing non-trauma urgent major medical and surgical ICU cases from within the facility.

Descriptive Experience

The first steps taken were internal policy decisions to reduce the transmission risk of Covid-19 within the unit, since the area was a component of the scarce-skills resources for the province of KwaZulu-Natal. Additional personal protective equipment (PPE) was urgently procured to ensure the access to disposable surgical gowns, double gloves, N95/FFP3-type masks and visors. Donning and doffing training for all hospital staff was provided. Staff numbers were kept to the minimum on shift to manage the incoming patients, with full PPE worn by both doctors and nurses in both the resuscitation area (where that level of PPE was routine under normal circumstances) and in the ICU during new patient activity (where normally scrubs and gloves only were worn previously). Only once a patient was proven PCR-test negative was the need for full PPE in the ICU area reduced.

One of the advantages of doing trauma-care is that staff was fortunately used to donning full PPE during

trauma resuscitations and therefore training time was reduced. For routine other work and on ward-rounds all staff were required to change into hospital scrubs from arrival at work till return to home, to minimise potential contamination of their personal clothing, wearing masks at all times and reduced numbers of people per area with adequate social distancing being practiced. Good hygiene practice was also enforced, including regular chlorhexidine-in-alcohol hand sanitising between patient-contact events and regular wipe-down of hard surfaces with 70% alcohol sanitisers.

Ambulance service personnel (EMS) were also instructed to ensure that they wore more adequate PPE and provided sufficient advanced notice of arrival to enable donning of PPE to be complete on EMS arrival. They were provided with PPE relevant to the pre-hospital scenario, usually in the form of disposable overalls with hoods and face-shields with N95-type masks. For the Covid-positive transfers specific vehicles with specially-trained crew were designated and equipped. Wash-bay facilities for post-transfer decontamination were available in the IALCH ambulance-area.

Self-care was practiced in that each staff member had to submit a daily symptom-check including temperature, pulse rate, respiratory rate and symptom-screen on arrival. Any case had full contact-tracing and risk-profiling done with liberal PCR-testing offered to at risk staff on day-5 post potential exposure.

Since all trauma patients were considered possible asymptomatic carriers, given the fact that risk-taking behaviour is associated with trauma-admissions, we decided to implement a system of routine PCR-test for all intubated trauma ICU (TICU) acute admissions. This was in the form of an endotracheal aspirate specimen also sent for routine culture and TB-GeneXpert. Extubation (an aerosol-generating event) was not undertaken until the PCR-test was returned as “negative”. This reduced further the transmission risk to our nursing and medical staff, as all patients had closed-suction devices and therefore aerosolization was limited. If the test was returned as “positive”, which did occur in the case of some patients, the intubation status was maintained and they were transferred to the Covid-positive ICU. Once patients had survived their isolation period of 14 days they were subsequently treated as “immune” and transferred back to the Trauma ICU for further care. Elective cases that had been positive were not

retested within the first three months post-infection.

In cases where a patient was found to be Covid-positive the area was kept empty for a period of 4-6 hours to enable the disinfection of that ICU pod. Fortunately, bed-spacing was approximately 3 meters between beds and across opposite beds ensuring sufficient distance to be able to continue using those beds, given the closed suction sets and non-extubation until the PCR-test was result. This ensured safe care of other TICU patients in the unit. This did, however, lead to delays with trauma-imaging due to the cleaning of the CT-scanner after all status-unconfirmed patients.

We did also have access to Covid-“rapid” tests from about February of 2021 and these were used for screening at most of the district and regional hospitals that refer patients to the facility, however we experienced problems with the “rapid” tests, namely a number of these were initially “negative” and the subsequent PCR-test, which took longer to result would then return a “positive” result, necessitating moving patients from the TICU to the Covid-ICU.

For patients who had damage-control trauma surgery and required subsequent further surgical procedures the PCR-test was repeated every 5th-7th day to ensure that no seroconversions were missed – with the proviso that Covid-positive patients had their surgery in the designated Covid-positive operation room, while Covid-negative patients were operated in the usual trauma room, situated between the TICU and the Resuscitation area.

Other administrative changes that were taken to reduce transmission risk within the team, yet to ensure ongoing mission-integrity of the IALCH role as a medical-school affiliated trauma and burn-care training unit included: all weekly trauma-academic and morbidity/mortality meetings were moved to the Zoom® (Zoom Video Communications, San Jose, CA) platform; undergraduate lectures were placed on the student on-line platform (Moodle™, Moodle Pty, Ltd, West Perth, Australia) as pre-recorded slide-shows with voice-over and interaction for queries was via email or other similar platforms, and at the request of the university ethics committee any in-person research aspects were placed on hold. Retrospective chart review and similar non-contact research was allowed to continue, which included routine antibiotic stewardship and surveillance monitoring.

Visitation policies restricted family visits unless

the patient was terminal and for one relative for a maximum of 15 minutes, provided they wore full PPE. Telephonic systems for video-call and family follow-up were arranged.

The clinical experience has been as follows: Since 28 March 2020, when the South African president declared a National Disaster ⁵, until the end of the 2nd wave in South Africa (end of March 2021) the TICU admitted 478 patients of which 317 were trauma ICU cases and 161 were non-trauma, supposedly non-Covid cases requiring ICU care, both for medical indications or post-operative care for major surgery. ICU Mortality was 49 (15.5%) for the trauma admissions (including six dead-on-arrival at Resuscitation Unit) and 23 (14.3%) for the non-trauma cases. These mortality rates are in keeping with the pre-Covid rates in the unit and in line with expected benchmarks in the trauma population.

Of this entire cohort 26 (5.5%) cases were found to be Covid-positive (one non-trauma case positive at post-mortem) and were transferred to the Covid ICU, where a further seven of the Covid-positive cases succumbed to their illness. Of these Covid-positive cases there were fifteen trauma cases and eight non-trauma cases. To reduce the exposure of staff we changed our airway management policies to include video-laryngoscopy, facial covering and starting the ventilator only after connection of the endotracheal tube post intubation.

While the trauma cases who tested positive were emergency admissions and could not be prevented, the eight non-trauma admissions demonstrated that there was a need for routine Covid-testing in the ward prior to major planned surgery or on admission to the medical service. This finding led to a change of policy, with routine testing of all ward admissions using a PCR-test instituted and TICU beds would only be offered to Covid-negative confirmed non-trauma cases as to ring-fence these beds.

During this entire time period only one consultant and three other medical staff developed clinical Covid symptoms, fortunately identified early with self-isolation, out of a total medical staff complement of 36 doctors rotating through TICU during the time under review. None had in-hospital confirmed contacts. All returned to work after their 10-day isolation. There were 13 nurses in the trauma ICU who was infected, from a team of over 50 nurses, but mostly from social contacts, with no overtly proven cases of patient-to-provider transmission found on

out-break investigations undertaken by the hospital infection control team. Unfortunately, one of the nurses died from her infection, which was acquired while on leave. In the early phase of the pandemic a number of experienced nurses resigned due to fears of Covid-transmission and this loss of institutional memory is concerning.

A further area of concern for inter-staff transmission was the tea and lunch rooms, due to size and the need to unmask. This was addressed by staggering lunch and tea times, or for staff who had personal offices, meals were eaten in solitude in the office. Vulnerable staff (with co-morbidities) were given restricted shifts, but as healthcare workers were ethically obligated to work.

A further challenge identified with the increased use of alcohol-based sanitisers is the apparent development of alcohol-resistance in certain multi-drug resistant bacterial strains, particularly Enterobacteriaceae⁶⁻¹⁰. It was also noted that patients were colonised earlier by multi-drug resistant organisms, including Acinetobacter and Aeromonas – a finding of significant concern in the light of the limited antibiotic choices open to a resource-constrained environment. The unit has in the past been able to ensure low resistance rates and good antibiotic stewardship^{4,11}. The theoretical mechanism of this resistance is transfer of free DNA particles between hardy bacteria

resulting in alcohol resistance⁷⁻¹². This horizontal gene transformation induces the enrichment effects of antibiotic resistance genes in resistant bacteria through the uptake of naked DNA and mobile genetic elements such as plasmids, transposons, integrons, gene cassettes, and bacteriophages. Therefore, viral disease leads, both directly and indirectly to antibiotic resistance, compounding the challenges in caring for sick ICU patients.

Conclusion

In conclusion the trauma care required in the Covid-19 pandemic has undergone changes and challenges that have been taken head-on and by actively addressing these aspects led to continued service provision and no worse than expected patient outcomes. The risk of antibiotic resistance generation is a major concern for successful treatment of future patients.

The take-home message is that “doing the basics right” will effectively allow for efficient and effective trauma care in the midst of the pandemic. As South Africa currently faces the third wave of Covid-19 these principles will continue to provide staff safety and timely access to care.

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