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REVIEW

Critical care nephrology: could it be a model of multidisciplinarity in ICU nowadays for other sub-specialities – the jury is out

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Abstract: Emergency and critical care medicine have grown into robust self-supporting disciplines with an increasing demand for dedicated highly-skilled physicians. In the past, "core" specialists were asked to offer bedside advice in acute care wards. In the same regard, critical care medicine and nephrology have been fighting but finally emerged altogether with the concept of critical care nephrology almost 20 years ago. Indeed, polyvalence is no longer a valid option in modern critical care. Uniting forces between disciplines represents the only way to cope with the increasing complexity and cumulating knowledge in the critical care setting. For this reason, the wide array of upcoming acute care sub-specialities must be committed to unrestricted growth and development. This will require competent manpower, a well-designed technical framework, and sufficient financial support. The worldwide success of critical care nephrology proves the feasibility for this concept.

Keywords: translational medicine, multidisciplinarity, acute medicine, CRRT, dialysis, critical care nephrology

Introduction

For decades, critical care medicine and nephrology have been fighting but finally emerged altogether with the concept of critical care nephrology almost 20 years ago.[1] Emergency and critical care medicine have grown into robust self-supporting disciplines with an increasing demand for dedicated highly-skilled physicians. In the past, "core" specialists were asked to offer bedside advice in acute care wards. Yet, the "acute" patient often lacks the typical features of a particular pathology but rather displays a subacute, hyperacute or "patchwork-like" disease pattern.

Material and methods

In order to further elaborate on this concept, we would like to present a case report highlighting this atypical presentation of a disease while the patient was in an intensive care unit (ICU). A 51 year-old male was admitted to the ICU after bilateral nephrectomy for invasive urothelial cancer in order to benefit from hemodynamic monitoring in the first 48 hours following the operation. The first 24 hours were uneventful. After 48 hours, the patient developed high fever up to 40°C with a typical distributive shock pattern. The patient's c-reactive protein was elevated (250 mg/L) and the intensivists were considering whether this patient was developing septic shock. After realizing all the cultures, the patient was taken for a computed tomography (CT) scan of the abdomen which did not reveal an abscess. So, although the patient was considered as a septic shock patient, they found no problematic source whatsoever. They started the patient

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on antibiotics (Tazocin 4 g TDS and amikacin 25 mg per kg). The patient was further adequately resuscitated with adequate volume loading and then started on a noradrenaline infusion at a dose of 0.1 mcg/kg/min. The patient was also placed under continuous veno-venous hemofiltration. After 72 hours, the patient further deteriorated needing an increase in the nonadrenaline infusion up to 1.9 mcg/kg/min. The patient had received 5 L of fluids within 24 hours. He still had a high fever of 39.5°C. The infectiologist and the microbiologist at his bed were thinking about enlarging the antimicrobial coverage in order to treat potentially drug-resistant gram-negative bacteria and also fungal infections, despite the fact that all the cultures remained negative. Ultimately, before enlarging the microbiological cover, the intensivist decided to call a senior nephrologist-intensivist in order to obtain a second opinion. For the senior intensivist, it was relatively clear as he had seen a very similar case some years ago. For him, a bilateral nephrectomy means in the majority of the cases, a bilateral resection of the adrenal glands. While classical Addison's disease can include severe fatigue and weakness, loss of weight, increased pigmentation of the skin, faintness and low blood pressure, nausea, vomiting, salt cravings, and painful muscles and joints – under the acute setting, the situation is extremely different and this acute case of Addison's disease may be mimicking septic shock with high fever. Later the same day, the patient was given 100 mg of hydrocortisone in bolus followed by an infusion of 300 mg of hydrocortisone given through an electrical syringe pump. The patient's condition was completely normalized within 12 hours and all antimicrobials were stopped. This case illustrated that a specific disease may have a completely different presentation while the patient is in ICU and therefore, need specific knowledge about atypical intensive care presentation of a disease.

Discussion

Moreover, it becomes increasingly difficult for an entirely "organ-focused" physician to discern the multitude of potential pitfalls that complicate diagnosis and treatment in an acute setting. From the case presented here, it is obvious that acute care departments need to be manned with "specialized" acute care physicians to ascertain timely diagnosis and adequate treatment of patients.[2] The list of involved sub-specialities is steadily growing and has recently welcomed nephrology, infectious disease, pharmacology, and endocrinology.[3,4] Of course, no single intensive care or emergency physician is able to remain fully updated on the ever expanding knowledge and practice regarding these subspecialities.[3–5]

As a result of competent manpower, we underscore the need to have intensivists and acute care physicians who have been trained initially in another primary speciality for instance nephrology, cardiology, infectious disease, pharmacology, and endocrinology. In order to be successful, they need to work in a full time position in ICU or in an acute care setting developing their primary speciality inside ICU and acute care. If they return to their initial speciality, this will result in a complete failure regarding the development of competent manpower. As one may easily understand, this condition of competent manpower is extremely linked with the two other conditions (well-designed technical framework and sufficient financial support) that we shall expand on in other paragraphs.

Nephrology, for example, has evolved at such a pace over the past decades that it needed to be subdivided in to dialysis chronic care, kidney transplantation, peritoneal dialysis, and critical care nephrology, each focusing on a specific patient population.[5,6] From its creation almost 20 years ago,[7,8] critical care nephrology has progressively become a key component in acute care. Many critical care physicians – some of them even without a specific nephrological background – have become highly qualified international experts in the management of acute kidney injury. Critical care nephrologists can also tackle specific aspects of acute care. One such issue is antimicrobial "fine-tuning" in patients undergoing continuous renal replacement therapy (CRRT). When adapting currently accepted antimicrobial dosing guidelines in CRRT, a majority of patients will be left underdosed.[9] Thanks to the outstanding pioneer work of several groups, dose adaptation regimens for antimicrobial drug therapy under CRRT have been created and molded into workable bedside schemes.[10–12] This is unacceptable since it exposes patients to inadequate treatment and will induce resistance.[13] Optimal clinical care would need the use of loading doses followed by continuous infusion for administration of time-dependent antibiotics and the use of considerably higher bolus doses of concentration-dependent antibiotics.[10–13]

Another example is the recently re-discovered cardio-renal syndrome. Hereupon, the associated viewpoints of critical care nephrologists, cardiologists, and intensive care physicians[14] allowed for better insight into pathophysiology and a more efficient therapeutic approach.[15] If we take the example of the cardio-renal type I syndrome,[14,15] the cardiologist will give insight in order to improve the cardiac function not only systolic but also diastolic. A good example is the rediscovery of the use of nitroprusside[16] for diastolic dysfunction which can lead also to cardio-renal syndrome.[14,15] It is clear for every clinician that nitroprusside can only be safely

used while the patient is in ICU. The nephrologist will also play an important role here as fluid overload is extremely serious and if the patient does not respond adequately to loop diuretics, a slow continuous ultrafiltration will be necessary[17] in order to remove fluid overload from the patient and get him back on the left side of the Frank–Starling curve subsequently improving the systolic function of the left ventricle.

Importantly, the coordination of all logistic issues on intermittent and continuous dialysis in an ICU setting[8] enables the generation of sufficient financial resources to engage a critical care nephrologist.[6,7,9] Sub-specialities such as infectiology, pharmacology, and endocrinology also fulfill an indispensable role in daily ICU management.[18] Critical care infectiology focuses (on a 24/7 basis) on antimicrobial treatment options in typical emergency and ICU conditions (eg, reanimation, acute shock resuscitation, etc). In addition, advice from the infectious diseases specialist can be summoned in various challenging situations that may not or only partly be appreciated by a "general" infectiologist (eg, prevention and treatment of emerging multi-drug resistant ICU pathogens, and[19–21] antibiotic dosing in patients undergoing complex therapies [eg, extracorporeal membrane oxygenation, CRRT, burn treatment, etc]).[11,12,20]

By describing a well-designed technical framework, we underline the importance of specific technical needs for intensive care physicians or acute care physicians while they wish to continue to develop their initial speciality. For instance, an echocardiography tool should have specific functionalities while in ICU and should be accessible 24 hours a day in ICU. Bronchoscopy material should also have specific features and be accessible at any time. Needless to say, CRRT devices should have specific features like potential extracorporeal CO^2 removal as additional module. Again, we can easily understand that the second requirement is tightly linked to the third one about financial support.

Life-threatening drug–drug interactions have been described in approximately 15% of ICU patients.[22] Also, up to 10% of ICU admissions are due to drug overdosing or interactions occurring in general wards.[23] As recently shown,[24] the introduction of critical care pharmacology as a "satellite" of its clinical counterpart can dramatically reduce these harmful events and thus improve patient safety and outcomes.[23–25] Protracted illness and its inherent metabolic and hormonal changes have paved the way for critical care endocrinology.[26] By unravelling the intricate hormonal pathways and stress interactions that accompany a stay in the ICU, this relatively new sub-speciality will probably contribute to lowering morbidity, length of ICU stay, and mortality.[27]

The third requirement is looking at the financial support for the appointment of this new critical care physician, and is obviously a key requirement. In order to increase the financial support of a new colleague, it is important that a new technique brought in by this new colleague and which is generating financial benefits, could be directly added to the ICU budget and not to any other department. Therefore, agreements need to be made between ICU and other departments regarding this financial rule: "whoever is performing the technique is getting the money". Also, the technique needs to benefit even in ICU from the same type of reimbursement (so the technique should be reimbursed at 100% like in other departments, and not 50% or less). Those two conditions are the two pillars needed in order to convince the hospital directors to invest the needed financial support into those subspecialties inside ICU, and to finally appoint those physicians, knowing that they will be bringing a substantial amount of money by implementing their techniques in ICU, broadening their scope of indications as they better master this pathology, the physiopathology, and the dedicated technique going along the same line.

Conclusion

In conclusion, polyvalence is no longer a valid option in modern critical care. Uniting forces between disciplines represents the only way to cope with the increasing complexity and cumulating knowledge in the critical care setting. For this reason, the wide array of upcoming acute care sub-specialities must be committed to unrestricted growth and development. This will require competent manpower, a well-designed technical framework, and sufficient financial support. The worldwide success of critical care nephrology proves the feasibility of this concept.

It is time to say goodbye to the omniscient intensivist and to welcome constructive multidisciplinarity as we welcomed critical care nephrology 20 years ago, although at the time with a lot of skepticism, but not anymore today!

Disclosure

The authors declare no conflicts of interest in this work.

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