



# Application of Enhanced Recovery After Surgery in Patients Undergoing Kidney Transplant: the Belfast Protocol

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## ABSTRACT

**Background.** The aim of this study was to assess the impact of the Belfast Protocol for enhanced recovery after surgery on hospital length of stay (LOS) after kidney transplant.

**Methods.** A prospectively collected database was analyzed for all consecutive renal transplant recipients in 2010 and compared with consecutive renal transplant recipients in 2018 before and immediately after the full implementation of the Belfast Protocol.

**Results.** There were 73 renal transplants in 2010 and 115 in 2018. Between 2010 and 2018 there was a significant decrease in LOS from 12 to 7 days ( $P < .0001$ ). Compared with 2010, in 2018 there was a significant increase in donor age (47 vs 54 years,  $P < .0001$ ) and kidney transplant from donation after circulatory death donors (0% vs 9%,  $P < .0001$ ). Although there was no change in the proportion of living donors (59% vs 50%,  $P = .32$ ), in 2018 there were more blood group incompatible living donors (0% vs 7%,  $P = .21$ ). Compared with 2010, in 2018 there was a significant increase in recipient age (43 vs 54 years,  $P = .0002$ ), diabetic nephropathy (5% vs 16%,  $P = .03$ ), and recipient body mass index  $>35$  kg/m<sup>2</sup> (0% vs 9%,  $P = .02$ ).

**Conclusions.** Implementation of the Belfast Protocol has decreased LOS in renal transplant recipients despite increasingly complex donor and recipient profiles.

**T**HERE is growing evidence supporting enhanced recovery after surgery (ERAS) protocols in kidney transplantation, with particular emphasis on reducing length of stay (LOS) [1,2]. During the coronavirus disease 2019 pandemic, the Belfast Protocol for ERAS resulted in a reported median LOS of 4 days after deceased donor kidney transplant [3]. The aim of this study was to assess the impact of the Belfast Protocol by assessing LOS.

## MATERIALS AND METHODS

The Belfast Protocol for ERAS was fully implemented as standard of care in 2018 (Table 1). A prospectively collected database was analyzed for consecutive renal transplant before (2010) and after (2018) full implementation of the Belfast Protocol for ERAS.

## RESULTS

There were 73 renal transplants in 2010 and 115 in 2018. Compared with 2010, in 2018 there was a significant increase

in donor age (47 vs 54 years,  $P < .0001$ ), kidney transplantation from circulatory death donors (0% vs 9%,  $P < .0001$ ), and blood group-incompatible living donors (0% vs 7%,  $P = .21$ ). Compared with 2010, in 2018 there was a significant increase in recipient age (43 vs 54 years,  $P = .0002$ ), diabetic nephropathy (5% vs 16%,  $P = .03$ ), and body mass index  $>35$  kg/m<sup>2</sup> (0% vs 9%,  $P = .02$ ). Between 2010 and 2018 there was a significant decrease in LOS from 12 to 7 days ( $P < .0001$ ). Decreased LOS was observed in the context of a significant increase in discharge creatinine (110 vs 170 mmol/L,  $P < .0001$ ). Readmission rate was observed to increase from 0% to 5%. See supplementary materials.

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**Table 1. The Belfast Protocol for ERAS in kidney transplant****Preoperative Care**

All patients are educated at preoperative surgical clinics and recipient coordinator information days regarding the principles of ERAS. Patients are advised on smoking cessation and weight reduction as appropriate. Patients are educated regarding the protocol for pain control with minimal use of opioid analgesia, short-term use of intravenous fluids and urinary catheter, and early mobilization.

**Intraoperative Care**

Central venous catheters are avoided in all patients where possible. Invasive blood pressure monitoring using arterial line is recommended; however, this is removed postoperatively, therefore allowing patients to be discharged to ward-level care. All patients receive a transverse abdominis plane block using 20 mL of levobupivacaine 0.375%. Diuretics and vasopressors are not used routinely. Intravenous fluid administration is minimized to approximately 1 L intraoperatively. To manage postoperative pain a transverse abdominis catheter is placed and primed with 20 mL 0.25% levobupivacaine. Drains are not routinely used.

**Postoperative Care**

Post operatively patients receive a daily pain team and physiotherapy review. Postoperative Hartmann's solution is commenced matching urine output and capped at 250 mL/h. Intravenous fluids are frequently discontinued after 6 h postoperatively once patient is tolerating oral fluids. Local anesthetic infiltration is continued for a further 24-48 h, depending on patient pain scores, and supplementary routine analgesia is limited to IV paracetamol. Patients have oxycodone hydrochloride (Shortec) prescribed as required. Early mobilization is encouraged by removing urinary catheters within approximately 48-72 h. All patients receive incentive spirometry and early physiotherapy.

**Discharge**

Patients are discharged when medically fit independent of graft function. All patients have an individualized postoperative clinic appointment schedule and target immunosuppressive regimen.

ERAS, enhanced recovery after surgery; IV, intravenous.

**DISCUSSION**

Implementation of the Belfast Protocol for ERAS was incremental from 2010, and during this period recipients have become older, are more obese, have more diabetic nephropathy, and from a living donor perspective present greater immunologic challenge in terms of blood group compatibility. Despite this increase in both donor and recipient complexity a significant reduction in LOS has been observed as a result of the Belfast Protocol for ERAS in kidney transplantation.

Hanson et al [4] reported a significant cost benefit to implementing an ERAS protocol in kidney transplantation, suggesting that up to \$5000 can be saved per patient associated with a reduction in LOS. Dias et al [2] also published their ERAS protocol after kidney transplant, yet despite this hospital LOS was

10 days, which is 3 days longer than our LOS for all recipients in 2018 and 6 days longer than our results during the coronavirus disease 2019 pandemic [3]. Their protocol includes central venous catheter placement, intra-arterial blood pressure monitoring, and drain placement. By minimizing invasive monitoring, the Belfast Protocol facilitates the management of patients at ward level. Halawa et al [5] published another ERAS protocol with excellent patient satisfaction and reduction in LOS. Consistent with the Belfast Protocol they removed urinary catheters early, thus improving mobility and reducing the risk of infection.

Discharge is not delayed because of graft function, and in the Belfast Protocol we have seen an increase in the number of readmissions to 5%; however, this is less than 9% from previously published data [2,4]. We believe this is the first transplant study from the United Kingdom to combine multiple aspects of an ERAS protocol namely fluid restriction, minimizing invasive monitoring, use of pain modification measures, early removal of urinary catheters, and discharge despite delayed graft function. A significant reduction in LOS as a result of the Belfast Protocol has been demonstrated.

**CONCLUSIONS**

Implementation of the Belfast Protocol has decreased LOS in renal transplant recipients despite increasingly complex donor and recipient profiles.

**SUPPLEMENTARY MATERIALS**

Supplementary material associated with this article can be found, in the online version, at [doi:10.1016/j.transproceed.2021.07.046](https://doi.org/10.1016/j.transproceed.2021.07.046).

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