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REVIEW

Dual surgeon operating lists for complex revision arthroplasty surgery: changing orthopaedic surgical practice

M Bansal[1]

NA Sandiford[2]

Author details can be found at the end of this article

Correspondence to:
M Bansal; mbansal@nhs.net

Abstract

There is an increasing trend towards dual surgeon operating in complex surgeries in various specialties. This is driven by regionalisation of services, increasing complexity of surgical procedures, the ageing population and challenges imposed by changes in surgical training. Dual surgeon cases have lower complication rates and better quality of patient care. This practice not only facilitates professional and personal development, but also provides valuable support to surgeons in the early part of their career. There is a paucity of literature to support this practice, however, and prospective studies are required to demonstrate the benefit of this approach.

Key words: Dual surgeon; Multimodal care; Revision arthroplasty

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The discipline of trauma and orthopaedic surgery faces unprecedented challenges in the future, with rapid advances in technology, ageing populations with multiple medical comorbidities, complex surgical procedures with increasing volumes of revision arthroplasty surgeries, financial constraints and changes to surgical training among others. The rate of complications in patients undergoing revision arthroplasty is also likely to increase with the number of revisions and increasing complexity of surgical procedures. Dual surgeon operating has been shown to reduce the complication rates in complex surgeries and could be an essential approach to provide value-added care to patients in the longer term.

Historical perspective

Surgeons typically function in isolation and manage simple and complex revision work at the individual level. Historically this approach was feasible, despite departments containing relatively small numbers of surgeons, because training differed, with an emphasis on gaining experience by having hands-on exposure to large numbers of surgical procedures.

Orthopaedic training has undergone massive changes in the last few decades from being experience and time based to a competency-based model, which focuses less on the level of experience gained over time. One objective of this approach is to train generalists who can provide basic orthopaedic care. Surgeons are now expected to sub-specialise in the early part of their consultant career in order to gain specialist experience (Fuller and Simpson, 2014).

Surgical practice continues to evolve at a rapid pace with new technologies, re-organisation of services and emergence of subspecialties to improve quality of care. To maintain the delivery of high-quality care, professional roles have changed over the last decade to provide a different model of care for managing patients. As part of this evolution dual consultant operating has been introduced in surgical specialties to maximise expertise and professional mentorship for less experienced surgeons and to maintain safe practice in complex surgical decision making and complex surgical procedures (Bauer et al, 2019).

‘Rule of two’

This concept is practiced as a norm in the airline industry, where safety is paramount. Technically, a pilot could fly a plane alone, but having two pilots is vital to optimise

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safety aboard an aircraft. Safety issues can result from fatigue, human error, inexperience or complex situations. Sharing the workload helps to manage complex systems during different phases of flights and helps pilots to remain alert during long haul flights. One pilot actively flies the aircraft and the other pilot is involved in managing the instrumentation and checklists, and communication with traffic control. It also helps to share the workload during key events such as take-off, landing and taxiing (Air Line Pilots Association, International, 2019). Having two pilots improves coordination of actions in the cockpit by regular communication and allows pilots to adapt to changing conditions – only 10% of flights conform to the original flight plan according to the Federal Aviation Administration (CQ Press, 2020).

Evidence for dual surgeon operating

The concept of dual surgeon operating currently exists in surgical specialties such as complex spinal surgery, cardiac surgery, surgical oncology, urology and breast surgery (Gurtner et al, 1994; Ludwig et al, 2005; Mallory et al, 2016). Benefits cited for this approach include improved safety and decreased rates of complications with dual surgeon operating in surgeries such as adult spine deformity (Scheer et al, 2017). A study reviewing single vs dual surgeon correction of spinal deformity reported decreases in blood loss and decreased return to theatre within 30 days for dual surgeon cases (Ames et al, 2013).

Studies reviewing surgery for adolescent idiopathic scoliosis reported reductions in surgical time, blood loss, length of stay, use of narcotic pain relief and greater curve correction in dual surgeon cases (Halanski et al, 2013; Kwan and Chan, 2017). This approach has been associated with a decrease in operating times, reduced length of stay and complications, but it has not showed universally improved outcomes. In procedures which involve complex decision making and require a long period of focus and performance, the authors feel that having another surgeon helps to maintain focus, avoids fatigue and improves performance. Each institution and case will have its own unique features and issues which will determine the function of each surgeon present. It might be that each surgeon has a specific skill set which is required for specific parts of a complex operative procedure or that one is inexperienced in a procedure and requires the support of a colleague with more experience in that procedure. Both operating surgeons are responsible for safe surgery and for obtaining the desired outcomes. This process needs to be carefully audited to ensure that patient safety is optimised, as with single surgeon surgery. There is currently a paucity of evidence to support this (Bauer et al, 2019).

Revision burden and complexity of procedures

The number of primary total knee arthroplasty procedures is increasing annually, with the ageing population and expanding indications for the procedure (Kurtz et al, 2007). As a result, the prevalence of revision arthroplasty is also increasing (Kurtz et al, 2007; Bhandari et al, 2012; Hamilton et al, 2015; Patel et al, 2015). Data from the USA and UK show a consistent increase in projected numbers of arthroplasty procedures to be carried out in future (Kurtz et al, 2007; Culliford et al, 2012). Factors that can result in the failure of total hip or knee arthroplasty include infection, loosening, bearing surface wear, fracture, malalignment, instability, extensor mechanism failure, stiffness and surgical technique (Ong et al, 2010; McCarthy and Glassner, 2013; Schroer et al, 2013; Meneghini et al, 2018).

The rate of adverse events differs significantly between primary and revision procedures. Several authors have shown an increased risk of systemic sepsis, surgical site infection, and organ or space infection with revision procedures (Bohl et al, 2016). Planning revision arthroplasty involves an understanding of the mode of failure of primary arthroplasty, taking into consideration patient factors, surgeon factors, soft tissue factors and bone loss. The incidence of complications is directly related to the volume of revision surgery performed (Groh and Groh, 2014; Ravi et al, 2014).

The changing face of revision arthroplasty

Healthcare is rapidly changing, and the demands placed on clinicians and healthcare systems are increasing steadily. The population is ageing. There is an increasing expectation for an active retirement, but there is also increasing body mass index and medical comorbidity in this group. Revision arthroplasty is a complex intervention which requires considerable resources, a multidisciplinary approach and multiple interventions, especially in cases of septic revisions (Bozic et al, 2010). It also is technically demanding, requiring detailed planning, appropriate instrumentation and implants, increasing the overall cost of the procedure and the overall episodes of care. The individual steps of the procedure pose unique challenges, beginning with exposure of the joint, removal of the component without bone or soft tissue compromise, adequate debridement, managing soft tissue defects, reconstruction of bone loss and use of complex instrumentation and implants including stems, augments, cones, sleeves, custom implants and newer technologies to provide stable and well-fixed, well-functioning implants (Peltola et al, 2013; Ravi et al, 2014; Meneghini et al, 2018).

There is a direct correlation between the volume of cases that a surgeon performs and the incidence of complications in complex surgical procedures which involve intricate planning and execution, especially those which involve use of new technology, multiple instrumentation and implants (Peltola et al, 2013; Groh and Groh, 2014; Ravi et al, 2014).

Health economics is changing rapidly with significant constraints on available resources. There is an emphasis on demonstrating good patient-reported outcomes and revision rates. It is imperative that these complex surgical interventions are planned appropriately and as efficiently as possible. The rate of complications goes up and survivorship goes down significantly in re-revision cases, which can lead to significant functional and psychological disability in these patients (Yu et al, 2017, 2020).

Orthopaedic training

The issue of a shortened period of surgical training, the impact of this on case exposure, surgical experience and ultimately the level and standard of care surgeons are able to provide, especially in the initial phase of their careers, has been highlighted in the literature (Fuller and Simpson, 2014).

Surgical training has undergone massive changes over the years, beginning with Calmanisation in 1996, and formalising training to competency-based run-through training under Modernising Medical Careers in 2005. The Tooke review commissioned by the Department of Health in 2008 abolished run-through training, moving to a more conventional core and specialty training. Professor Greenway led the Shape of Training review aimed at training surgeons with generic skills providing care to the ageing population with comorbidities. This would lead to decreased specialisation in an already shortened training period, with specialist skills acquired after training while working at a junior consultant grade (Fuller and Simpson, 2014).

Specialist societies have recommended that care providers work in a collaborative fashion to optimise surgical case exposure, surgical volume and minimise the incidence of complications (Hamilton et al, 2015). This can be achieved in an efficient manner by using dual consultant operating lists where a junior consultant works in close association with the senior surgeon and can acquire specialist skills with required mandatory case numbers.

The implementation of the hub and spoke model and establishment of networks in the UK, for complex surgery such as revision arthroplasty, makes it mandatory that the surgeons from spoke hospitals are encouraged to perform revision work in the nominated centre (the hub) if they can demonstrate that they perform adequate numbers of cases done in the preceding year. In the UK the proposed minimum annual caseload for the units performing knee revision arthroplasty surgery is 30+ and an individual surgeon achieving a volume of 15+, as highlighted in the British Orthopaedic Association and British Association for Surgery of the Knee (2020) Revision Total Knee Replacement Surgical Practice Guidelines.

Economic considerations

The cost of revision arthroplasty is high (Meneghini et al, 2018). In the current climate of rising costs, justifying the addition of another surgeon to an already staffed operating list might not seem intuitively to be economically viable. It also involves re-organisation of roles to provide cover for additional duties or changes to established working patterns. One way to reduce cost of the procedure is via complication avoidance, a concept which is considered in the theory of creating shared values (Porter and Kramer, 2011). This concept of implementing change to improve value and efficiency is adopted by several healthcare organisations and is similar to the Toyota Motor Company lean management model (Teich and Faddoul, 2013). Having a 'safety net' with two surgeons performing complex procedures can provide increased value to benefit the patient by reducing complications, hospital stay and operating time, thereby resulting in cost savings. Most importantly, this also provides benefits to the patient.

Rationale for dual surgeon operating

In this arrangement an operation which has been planned and deemed complex after discussion by a multidisciplinary team is performed by two surgeons of similar or varied levels of experience. To the authors' knowledge this practice is not uncommon in contemporary hospital practice, but there is a paucity of literature on this aspect of surgical care.

There is ample evidence from the aviation industry that having two qualified pilots on all commercial flights allows for cross-checking and identification of errors, improves coordination between flight and cabin crew, and optimises safety. The same concept could be replicated in surgical practice where surgeons are faced with complex, sometimes unpredictable situations. The presence of two experienced surgeons is likely to improve decision making, speed of work, coordination and thereby lead to better outcomes and reduced complication rates. Similar concepts are applicable to difficult surgical procedures such as revision arthroplasty as this involves complex preoperative planning and demands expedient, efficient surgery, often in unpredictable situations, to optimise resource use, patient outcomes and, logically, safety. Having another surgeon has been proposed by some authors to reduce the risk of errors, improve communication between theatre staff and make the process more efficient and safer (Ludwig et al, 2005; Ames et al, 2013; Halanski et al, 2013; Mallory et al, 2016; Bauer et al, 2019). It also facilitates mentorship among colleagues of differing levels of experience as well as teaching and learning of complex surgical knowledge, decision making and practical skills. This approach could potentially lead to reduced risks, improved outcomes, lower complications and optimised resource use.

Although there is a paucity of evidence to support this, anecdotal evidence has been reported in the literature. Further short- and long-term studies are required to confirm these findings. The authors believe that the surgeons performing the surgical procedure should share joint responsibility for the patient care and the consequence of the intervention. Hospitals should have written guidelines for this in accordance with the specialist society.

Conclusions

Dual surgeon operating for complex arthroplasty procedures has the potential to minimise complications as well as improving surgical safety and clinical outcomes. It provides a mechanism via which a surgeon can be supported in the early part of their career. This facilitates professional and personal development as well as collegiality. While there are challenges to implementing this model, it can add value to surgical practice for the institution, the surgeon and the patient. This model has been adopted by other professions, such as the airline industry, in which safety is paramount. It is already in use in several surgical centres. There is a paucity of literature to support this practice, however, and prospective studies are required to demonstrate the benefit or otherwise of this approach.

Key points

- Dual surgeon operating is a novel concept which is gaining support in surgical specialties to improve surgical safety and clinical outcomes.
- The presence of two experienced surgeons is likely to improve decision making, speed of work and coordination, thereby leading to better outcomes and reduced complication rates.
- This process also provides support to surgeons in their early years of training and contributes to professional development.

Author details

[1]Department of Trauma and Orthopaedics, Guy's and St Thomas' NHS Foundation Trust, London, UK

[2]Department of Trauma and Orthopaedics, Southland Teaching Hospital, Invercargill, New Zealand

Conflicts of interest

The authors declare no conflicts of interest.

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