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Smoking and orthopaedic surgery: does the evidence support rationing of care?

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Introduction

There are 9.6 million adult smokers in the UK - 19% of the UK population. (ASH (Action on Smoking and Health), 2016) Rationing surgery on the grounds of smoking status is a highly contentious issue. A recent report by the Royal College of Surgeons (RCS) highlighted that some Clinical Commissioning Groups (CCGs) enforce mandatory policies to deny or delay surgery for smokers, with 12% of CCGs reporting at least one mandatory smoking cessation policy prior to referral for routine surgery. (The Royal College of Surgeons of England, 2016) At one extreme, one CCG require patients who smoke to stop and provide evidence of this through attending smoking cessation programmes before planned, non-cancer surgical procedures. More recently, another CCG has stipulated that smokers will have their planned surgery delayed for six months unless they stop smoking for eight weeks. (Bodkin, 2016) (Shaw, 2016) A further 15% CCGs adopt less stringent, ‘voluntary’ policies; for example, one CCG advises smokers requiring

routine elective surgery must be recommended for smoking cessation services prior to their operation, with interventions taking place while the patient is on the waiting list. (Oxfordshire CCG, 2010) For orthopaedic surgery, 14 CCGs (7%) have a policy on stopping smoking prior to hip or knee replacement, with 8 CCGs (4%) having a mandatory policy denying patients who smoke from receiving hip and knee replacements.

Opinion remains divided on the merits of such policies. Politicians and national surgical organisations alike have referred to this geographical variation as “crude rationing” and the “most severe the modern NHS has ever seen”. While there are currently no national guidelines to formally guide CCGs and individual Trusts, the British Orthopaedic Association (BOA) have stated there to be “no clinical, or value for money, justification for refusing to fund hip or knee replacements based on BMI or smoker status”. The RCS’ president, an orthopaedic surgeon, has unequivocally stated that “leaving patients waiting in pain for treatment longer than is clinically necessary cannot be accepted”. However, in a fiscally constrained NHS, others have suggested potential clinical benefits to restricting surgery on the grounds of higher risk factors such as smoking or obesity, in order to optimise patient selection and achieve the best clinical benefit from joint replacement surgery.

Ultimately, with no definitive clinical guidance from the National Institute for Health and Care Excellence (NICE) or national surgical organisations to support mandatory bans for routine surgery on the basis of smoking status, there appears to be a non-evidence based lack of regional consistency between CCGs, resulting in a postcode lottery on whether patients are denied surgery. The RCS unequivocally state that it is “unacceptable” for treatment to be banned or delayed on the basis of smoking status, unless supported by robust evidence.

This article provides a timely review of the literature and proposes evidence-based practical guidance for clinicians involved with all stages of a patients’ surgery journey.

Risks of peri-operative smoking

Smoking is associated with decreased bone mass, particularly in the hip, lumbar spine, calcaneus and forearm, resulting in a 13% increased fracture risk. (Kanis et al., 2005) (Ward & Klesges, 2001) Coupled with a 43% greater risk of osteoporosis, this can increase fracture risk to 60%. (Costenbader, Feskanich, Mandl, & Karlson, 2006)

Most orthopaedic surgeons accept that tobacco smoking adversely affects healing. (Bhandari, Fong, Sprague, Williams, & Petrisor, 2012) Numerous studies have found smoking to be an independent risk factor for surgical site infections (SSIs), with OR ranging from 2.378 to 38.319, and rising for chronic smokers of more than 20 years. (Fisichella, Fenga, & Rosa, 2014) (Jain, Shukla, Singh, & Kumar, 2015) (Durand, Berthelot, Cazorla, Farizon, & Lucht, 2013) (Li, Guo, Ou, Dong, & Zhou, 2013) (Edmonston & Foulkes, 2010) (Hawn et al., 2011)

The rate of surgical wound complications, including haematomas, discharge or wound dehiscence, is also significantly higher in smokers than non-smokers. (Durand et al., 2013) In a study of 811 patients undergoing total knee or hip arthroplasty, of which 28.6% were smokers, smoking was the single most important risk factor for the development of post-operative wound healing problems, cardiopulmonary complications, and requirement of post-operative intensive care. (A. M. Moller, Pedersen, Villebro, & Munksgaard, 2003) Several large studies have also reported increased odds of overall post-operative mortality in current smokers, compared with both never and ex-smokers. (Hawn et al., 2011) (Musallam et al., 2013)

Smoking has negative effects on the musculoskeletal system, for example delaying fracture healing and graft incorporation. (Porter & Hanley, 2001) (Karim, Pandit, Murray, Wandless, & Thomas, 2006) In a study of 146 closed or Gustillo Anderson grade I open tibial shaft fractures treated by cast immobilisation, external fixation, or intramedullary rod fixation, there was a significant increase in healing time in smokers (269 days vs. 136 days). (Abate, Vanni, Pantalone, & Salini, 2013) A systematic review, which explored influence of smoking on tendinous, ligamentous, and cartilaginous healing following shoulder surgery, found an increased

need for surgical revision of SLAP (superior labral tears from anterior to posterior) tears in smokers. (Santiago-Torres, Flanigan, Butler, & Bishop, 2015) Similarly, a systematic review investigating the effects of smoking on ligament and cartilage healing following knee surgery, found smoking to adversely influence healing. Complex regional pain syndrome, an uncommon complication of orthopaedic surgery, also has a higher incidence in smokers. (Rewhorn, Leung, Gillespie, Moir, & Miller, 2014)

Interestingly, while studies have shown a significant association between orthopaedic surgery and a higher risk of post-operative deep venous thrombosis (DVT), smoking has not been demonstrated to be an independent risk factor for this complication. (Edmonds, Crichton, Runciman, & Pradhan, 2004)

Strategies to aid smoking cessation

With demonstrated adverse links between smoking and post-operative healing, complications, and outcomes, smoking cessation has been logically thought to benefit patients undergoing orthopaedic and other surgical procedures. (Kanneganti et al., 2012) A growing body of evidence exists to support this hypothesis, demonstrating improved orthopaedic and general outcomes following smoking cessation. (Doll, Peto, Boreham, & Sutherland, 2004) Alongside general medical benefits, secondary orthopaedic benefits also exist, including increased bone mineral density after one year, and a reduction in fracture risk from 10 years. (Oncken et al., 2006)

Educating patients as to why and how smoking cessation prior to surgery is of benefit is an essential step. Several studies have found patients have little/no awareness that smoking can increase surgical risks, with many (up to 50% in one study) reporting having no counselling from healthcare professionals on quitting smoking prior to surgery. (Bottorff, Seaton, & Lamont, 2015) (Walker, Morris, & Cannon, 2009) Patients often under-report their smoking status; as patient dialogue and ‘buy-in’ to interventions is key, novel screening techniques, such as urine cotinine dipstick, may be cheap and effective tools to identify smokers and initiate counselling. (Salandy, Malhotra, Goldberg, Cullen, & Singh, 2016)

The UK Department of Health advocate ‘the 3As’ to approach smoking cessation with patients. **(Table 1)** (Department of Health, 2009)

Interventions proven to be effective include: clinician interventions (e.g. advice, self-help materials, referral for more intensive support); individual behavioural counselling; group behaviour therapy; pharmacotherapies (including nicotine replacement therapy (NRT), varenicline or bupropion); telephone counselling and quit-lines; and mass-media campaigns. (Excellence, 2016)

Individual counselling is of particular benefit; in a study of 25 identified smokers prior to foot/ankle surgery, 16 stopped smoking before their surgery, and 4 reduced their intake as a direct result of counselling. (Walker et al., 2009) A similar study also found significantly improved maintenance of cessation at 12 months in those receiving some form of intervention, compared to those that did not (25% vs. 8%, RR 3.0), with a number needed of 5.9 (95% CI, 3.4-25.9) to achieve smoking cessation for one patient at 12 months post-operatively.(Lee, Landry, Jones, Buhrmann, & Morley-Forster, 2015) However, other studies advise caution in concluding that longer-term abstinence is maintained; while interventions, including NRT and counselling, are generally reported as yielding short-term quit rates ranging from 18 to 93% (mean 55%), by 6-months there is not always a significant difference in abstinence rates between those receiving intervention and those not. (Cropley, Theadom, Pravettoni, & Webb, 2008)

Counselling tailored towards individual patient factors may improve overall abstinence rates. (Rechtine, Frawley, Castellvi, Gowski, & Chrin, 2000) More prolonged, ‘higher’ intensity interventions, coupled with persistent counselling and NRT, have been particularly shown to have a significantly greater impact on reducing smoking cessation pre-operatively and at 12 months post operatively, and consequently on reducing postoperative complications, as compared with ‘medium’ or ‘low’ intensity interventions. (Thomsen, Tonnesen, & Moller, 2009) (Thomsen, Villebro, & Moller, 2010)

When should cessation interventions take place?

It is unclear what the minimum duration of pre-operative abstinence should be to yield optimal benefit.

Some early studies raised concerns about stopping smoking shortly (i.e. fewer than eight weeks) prior to surgery due to a suspected increase in post-operative pulmonary complications. However, recent studies, including a systematic review, have found a beneficial effect of recent quitting compared with continuing smoking. (Myers, Hajek, Hinds, & McRobbie, 2011) (Shi & Warner, 2011) The review found recent quitting before surgery (within eight weeks) was not associated with a significant change in overall post-operative complications (RR= 0.78; 95% CI 0.57-1.07); while therefore not sharing the conclusion of the wider literature pool that smoking cessation at any stage can yield benefit, this nonetheless refuted any concerns of greater risk from abstaining smoking recently prior to surgery.

One systematic review found that smokers who quit more than eight weeks prior to surgery had lower risks of respiratory complications than current smokers (RR 0.77, 95% CI 0.61-0.96; and RR 0.53; 95% CI 0.37-0.76, respectively). (Wong, Lam, Abrishami, Chan, & Chung, 2012) However, there were similar complication rates in smokers who quit fewer than two, or two-to-four weeks, prior to surgery (RR 1.2, 95% CI 0.96-1.5; and RR 1.14, CI 0.9-1.45, respectively). Longer duration of abstinence may confer greater benefit, with one study reported that smoking cessation at least 12-months' prior to major surgery completely abolished the increased risk of post-operative mortality. (Musallam et al., 2013) In practice, this duration may be impractical from a pre-operative planning perspective.

The consensus from the literature is therefore that a greater duration of abstinence prior to surgery can yield greater benefits, with interventions commencing at least four to eight weeks prior to surgery more likely to have an impact on reducing post-operative complications and maintaining longer-term smoking cessation. (Thomsen et al., 2010) This is consistent with the

physiological effects of smoking on the body. **(Table 2)**

The role of healthcare providers

Healthcare providers have a crucial role in helping patients benefit from smoking cessation interventions. In an era of increasingly scrutinised outcomes data, this is also of benefit to clinicians and hospitals themselves.

Unfortunately, there is evidence to suggest that clinicians are failing to refer patients to smoking cessation services due to an under-estimation of their peri-operative and longer-term benefit. A UK questionnaire-based study of 120 non-vascular surgeons found 88% had not referred any elective patients to smoking cessation services in the previous month, primarily due to a perceived underestimation of the benefits of such programmes. (Owen et al., 2007) A similar study found only 31% had personally provided smoking cessation advice to at least one patient in the previous month, despite believing in the benefits such behaviours have on reducing complications. (Ozturk, Yilmazer, & Akkaya, 2012) Most participants did not appreciate that providing advice, referring patients to cessation services, or prescribing NRT, would be of benefit in helping patients quit smoking.

Other studies have found that despite asking patients about their smoking habits, few clinicians did anything with this information. (Pursell & Galland, 2005) Interestingly, surgeons were less likely than physicians to offer cessation advice, alternative NRT therapy, or to discuss smoking-related health problems and the benefits of quitting. Educating surgeons to the efficacy of smoking cessation services and their personal responsibility as clinicians to initiate such conversations and referrals is therefore vital in ensuring patients gain the evidence-based benefits of smoking cessation on both peri-operative and general health outcomes.

Going forward, it is important that for patients to benefit from smoking cessation advice and interventions, counselling should take place at every opportunity. While more formal pre-operative interventions usually occur in the general practice or outpatient clinic setting, the NHS

should also advocate the benefits of more opportunistic interventions for patients already in secondary care. Intercurrent illness can provide an incentive for patients to quit, with more motivated patients potentially more receptive to interventions, particularly within the 'non-smoking' confines of hospital buildings. (Rigotti, Munafo, & Stead, 2007) (NHS Smokefree, 2010)

Discussion

The NHS is facing growing financial difficulty, with NHS providers and commissioners ending 2015/16 with a deficit of £1.85 billion – the largest deficit in the NHS' history. (The Royal College of Surgeons of England, 2016) Unsurprisingly, a recent RCS survey therefore found over one-third of UK CCGs were considering introducing new thresholds for eligibility of services, for financial, value or efficiency reasons. Smoking and obesity status are two primary grounds upon which patients are being increasingly denied planned surgery, despite the lack of clear evidence or guidance to support this. Such measure have been argued as unfair, unethical, and ultimately 'financially-driven', with the potential to worsen health outcomes by delaying surgery. (Shaw, 2016)

There is a growing body of evidence to indicate the benefits of smoking cessation on reducing peri-operative complications and improving general health. Structured, patient-specific smoking cessation interventions targeted at the pre-operative stage result in decreased smoking rates around the time of surgery, and can also provide continuing health benefits through smoking abstinence at 12-months post-operatively. Peri-operative healthcare providers therefore have a unique opportunity to assist patients in smoking cessation and achieve long-lasting improvements, in both, post-operative outcomes and general health.

However, there remain unanswered questions. In particular, the ideal duration of cessation prior to and following surgery to achieve optimal benefit, remains unclear, as does the relative degree of benefit from reduction in smoking vs. complete cessation, and whether outcomes are universally improved for all types of surgery. Answering such questions is important, because in a struggling utilitarian NHS, restricting surgery on the grounds of proven higher risk is arguably

a fairer and more evidence-based strategy than the current geographically variable rationing based on local finances. Furthermore, a clearer national consensus could assist healthcare providers in appropriately counselling patients. In the absence of such clear guidance, the RCS recommend referral to smoking cessation support programmes alongside referral for clinically necessary surgical treatments, rather than smoking serving an absolute barrier. (The Royal College of Surgeons of England, 2016)

The NHS ‘Smokefree’ programme currently recommends smoking cessation “8 weeks or more before admission” as an optimum amount of time “for the body to recover from the immediate effects of smoking” prior to orthopaedic surgery. (NHS Smokefree, 2010) Consistent with the literature, this programme also advocates the potentially worthwhile benefits of even temporary abstinence, “beginning immediately around the time of admission, whether planned or unplanned and lasting until a patient has recovered”. Ultimately, smoking status should serve a prompt to promoting better health behaviours rather than as a prejudicial weapon with which to fight funding deficits.

Competing interests

The authors have no conflicts of interest related to this piece of work.

Tables and figures

Table 1: The 3As approach to smoking cessation

1) Ask	**…** and record smoking status
2) Advise	**…** the patient on the personal health benefits of quitting;
3) Act	…on the patient response (prescribe NRT, monitor withdrawal, refer to local NHS Stop Smoking Services).

Table 2: Physiological effects of smoking on the body (adapted from (NHS Smokefree, 2010))

Effect	**Impact**	**Recovery time (estimated)**
Increased sympathetic tone (Warner, 2006)	Increased oxygen and cardiac demand	24-48 hours
Carboxyhaemoglobin formation (Rietbrock, 1992) (Akrawi & Benumof, 1997)	Reduced tissue oxygen delivery and storage	8-24 hours
Increased red blood cell production (A. Moller & Tonnesen, 2006) (Ambrose & Barua, 2004)	Increased blood viscosity and thrombotic risk; decreased tissue oxygen perfusion	Unclear
Mucus hypersecretion, narrowing of small airways, decreased ciliary function, change in mucus function (A. Moller & Tonnesen, 2006) (Ambrose & Barua, 2004)	Respiratory compromise	12 -72 hours
Immune modulation (increased cytokine, white blood cell and immunoglobulin activity) (A. Moller & Tonnesen, 2006) (Ambrose & Barua, 2004)	Decreased immunity; atherosclerosis	1-8 weeks
Induction of hepatic enzymes (Zevin & Benowitz, 1999)	Increased drug metabolism	6-8 weeks

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