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Driving after Upper or Lower Extremity Orthopaedic Surgery

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Abstract

Orthopaedic procedures can affect patients' ability to perform activities of daily living, such as driving automobiles or other vehicles that require coordinated use of the upper and lower extremities. Many variables affect the time needed before a patient can drive competently after undergoing orthopaedic surgery to the extremities. These variables include whether the patient underwent upper or lower extremity surgery, the country in which the patient resides, whether the right or left lower extremity is involved, whether the dominant arm is involved, whether the extremity is in a cast or brace, whether the patient has adequate strength to control the steering wheel, and whether the patient is taking pain medication. The type and complexity of the procedure also influence the speed of return of driving ability. Few studies provide definitive data on driving ability after upper or lower extremity surgery. Patients should be counseled not to drive until they can control the steering wheel and the pedals competently and can drive well enough to prevent further harm to themselves or to others. This review discusses the limited recommendations in the literature regarding driving motorized vehicles after upper or lower extremity orthopaedic surgery.

Keywords
- driving
- lower extremity
- motorized vehicle
- orthopaedic surgery
- upper extremity

Introduction

Driving is an integral component of functional living in modern society, and being able to drive safely is a key responsibility. However, driving, although frequently regarded as mundane or rudimentary, is quite complex. Driving requires precise coordination between the central nervous and musculoskeletal systems. Therefore, the decision about when a patient can drive safely after orthopaedic surgery is an important and difficult choice.

Despite the importance of this issue, no formal guidelines are available for patients or physicians to reference after orthopaedic surgery.[1–3] The decision to resume driving involves numerous factors.[4] Regardless of the multifactorial nature of the issue, medicolegal trends, including possible litigation, are commonly putting the responsibility for the decision solely on the patient.[1,5,6] Some authors have advocated that physicians should not give detailed advice about when a patient can resume driving.[7]

Although there are no standard guidelines, the issue has been explored in the literature. Many authors have made recommendations about when it is appropriate to resume driving after undergoing a particular surgical procedure, but few studies of upper and lower extremity procedures are available to guide patients and clinicians. In this review, we summarize the literature on driving a motorized vehicle after undergoing upper or lower extremity surgery. Studies describing driving after spine surgery, pelvis surgery, or amputations were excluded. The purpose of this review is

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to help orthopaedic surgeons make informed recommendations regarding patients' driving after upper or lower extremity orthopaedic surgery.

Lower Extremity

Lower Extremity and Driving

Many variables affect the ability to drive after lower extremity surgery and the time required before patients can safely resume driving. The most important factors are the anatomic location of the surgery, the type of procedure performed, the extent and complexity of the surgery, and whether immobilization devices are needed. Country-specific traffic laws and standards must also be considered.

Most studies on driving focus on a patient's ability to react to an emergency when driving.[3,8] Several studies have objectively measured this using driving simulators to determine brake reaction time (BRT), brake travel time (BTT), reaction time (RT; also called initial reaction time), movement time (MT; also called foot movement time), and total braking time (TBT; ►**Table 1**).[2,3,8–26] Unfortunately, these terms are often used interchangeably, making study comparisons difficult.

Lower Extremity Immobilization

Orthopaedic procedures performed on the lower extremity are treated postoperatively with a splint, brace, boot, or cast. The type of material used in the cast or splint can influence which activities the patient can perform. Similarly, the type of brace, the materials that constitute the brace, and the range of motion allowed by the brace influence the decision to allow a patient to drive a motorized vehicle.

Patients routinely ask their treating surgeons if it is safe for them to drive while immobilized, and many patients drive without surgeon approval. Kalamaras et al[27] found that half of the 168 patients they surveyed during a 6-month period reported that they drove while wearing an upper extremity cast. In an anonymous survey of 118 patients, Kennedy et al[28] determined that 15% of patients reported driving with a low-leg or short-arm cast/splint.

Using a driving simulator, Dammerer et al[10] investigated the effects of various types of right knee braces on BRT. They analyzed BRT in 64 patients wearing the following: no knee brace (control group), a hinged knee brace with various degrees of flexion restriction (0–30, 0–60, 0–90, and 20–90 degrees), an offloading knee brace for unicompartmental arthritis, a knee sleeve, or an elastic knee bandage. They noted significantly longer BRT in all groups using the range-of-motion–limiting knee brace, regardless of degree of flexion restriction. None of the other braces tested affected mean BRT compared with nonbraced controls. Waton et al[25] examined the effect of long- and short-leg plaster casts, as well as hinged knee braces with varying degrees of flexion restriction on TBT in 23 people. The authors noted significant increases in TBT for above- and below-knee plaster casts. They also reported longer TBT for the hinged brace when it was in full extension, but, in contrast to Dammerer et al,[10] they found no significantly increased TBT with knee braces that allowed flexion to any degree.

The effects of boots, braces, and casts on driving ability after foot or ankle surgery have been reported by several authors.[8,22,25] Murray et al[22] investigated the effect of a pneumatic walking brace (Aircast Walking Boot, DJO Global, Vista, California, United States) or traditional walking cast on BRT compared with a control group wearing regular footwear. BRT increased by an average of 0.027 with the pneumatic walking brace and by more than 0.5 seconds with a walking cast (both, $p < 0.01$). Orr et al[8] examined BRT in patients with a traditional controlled ankle movement (CAM) walking boot or low-leg removable plaster cast and found significantly increased mean BRT in both groups. Overall, rigid immobilization of the right lower extremity prevents safe driving, and patients should be counseled accordingly.

Lower Extremity Arthroplasty

The number of hip and knee arthroplasty procedures in the U.S. and worldwide is projected to increase substantially in the coming decade.[29] These procedures have a well-elucidated effect on driving ability; however, there is disagreement and inconsistency in the literature about how long patients need to recover to be able to drive safely (►**Table 2**).[2,4,30] For example, the recommendations for right total knee arthroplasty (TKA) vary from 2 to 8 weeks.[31,32] This creates a difficult clinical and medicolegal environment for orthopaedic surgeons and patients, and it is critical that surgeons performing these

Table 1 Definitions of commonly tested variables used to objectively measure driving ability after orthopaedic surgery

Variable	Abbreviation	Definition
Reaction time or initial reaction time	RT or IRT	Time from stimulus appearance to start of release of gas pedal
Movement time or foot movement time	MT or FMT	Time from start of release of gas pedal to initial contact with brake pedal
Brake travel time	BTT	Time from initial contact with brake pedal to full depression of brake pedal
Brake reaction time	BRT	RT + MT (time from stimulus appearance to initial contact with brake pedal)
Total brake time	TBT	RT + MT + BTT (time from stimulus appearance to full depression of brake pedal)

Table 2 Return-to-driving recommendations after THA, TKA, or UKA

First author	Year	Procedure	Evaluation method	Recommendations/findings	
				Left side	Right side
MacDonald[19]	1988	THA	BRT	8 weeks	≥8 weeks
Spalding[32]	1994	TKA	BRT	No delay	8 weeks
Pierson[24]	2003	TKA	BRT	≥3 weeks	≥3 weeks
Ganz[13]	2003	THA	BRT	1 weeks	4–6 weeks
Berger[34]	2004	THA	Survey	6 days	6 days
Marques[21]	2008	TKA	BRT	–	30 days
Marques[20]	2008	TKA	BRT	10 days	
Liebensteiner[36]	2010	TKA	BRT	2 weeks	2 weeks
Abbas[33]	2011	THA	Survey	84% at 6 weeks[a]	79% at 6 weeks[a]
Dalury[9]	2011	TKA	BRT	–	4 weeks
Muh[60]	2012	TKA	Survey	1–3 months	
Jordan[17]	2014	THA	TBT	8 days	6 weeks
Liebensteiner[18]	2014	UKA	BRT	No delay	6 weeks
Hernandez[35]	2015	THA	BRT	–	2 weeks
Dalury[31]	2018	TKA	BRT	–	2 weeks

Abbreviations: BRT, brake reaction time; THA, total hip arthroplasty; TKA, total knee arthroplasty; UKA, unicompartmental knee arthroplasty.
[a]Refers to the percentage of patients who reported driving at 6 weeks after surgery.

procedures understand the evidence regarding patient factors that may influence safe driving.[1]

MacDonald and Owen[19] were among the first to study the effect of total hip arthroplasty (THA) on driving ability. They concluded that most patients could safely resume driving 8 weeks postoperatively, but that some patients require extended rehabilitation to return to baseline driving ability, which could take as long as 8 months.[19] Most studies indicate that BRT returns to preoperative levels or that patients felt confident about driving between 4 and 8 weeks after THA.[13,19,33] However, other studies suggest that patients may be able to drive sooner than 8 weeks.[34,35] Berger et al[34] advocated that patients could drive safely as soon as they stopped taking narcotic medication, which, in their study, was a mean of 6 days. The authors did not analyze objective data, such as BRT, but instead relied on patient surveys that asked patients when they thought they could safely start driving.[34] Hernandez et al[35] noted that 33 of 38 patients who underwent THA of the right hip had mean BRT of 0.576 $\pm$ 0.137 seconds by 2 weeks after surgery which was significantly better than the preoperative value of 0.635 $\pm$ 0.160 seconds ($p < 0.029$).[35] Jordan et al[17] examined the effect of left THA on TBT and found that patients returned to baseline levels 8 days after surgery.

TKA has been the subject of many biomechanical studies, especially to investigate the ability to perform an emergency stop.[3] However, findings on a safe return-to-driving timeframe vary. BRT returned to normal preoperative levels by 6 weeks or less in several studies.[9,21,24] Spalding et al[32] used a simulator to measure BRT at 4, 6, 8, and 10 weeks postoperatively and advocated that 8 weeks were needed before patients should resume driving. Conversely, in a study of BRT after TKA, Liebensteiner et al[36] urged that patients should not be restricted from driving beyond 2 weeks postoperatively, regardless of whether the procedure was performed on the left or right extremity. The same group found that BRT did not return to preoperative levels until 6 weeks after right unicompartmental arthroplasty and recommended that patients not drive until this point.[18] Marques et al[20] prospectively analyzed BRT in patients who underwent left TKA. They found that patients had slightly decreased RT in simple and complex braking tasks, at 10 days postoperatively, but these changes were nonsignificant. The authors concluded that patients who undergo left TKA can drive safely using an automatic transmission at 10 days postoperatively.

Systematic reviews have generated some recommendations regarding returning to driving after right THA and TKA[2,4] but no study, to our knowledge, has recommended a timeline that can be used as a definitive guideline for physicians or regulatory bodies. Some publications have suggested that there should be official guidelines from local or national government agencies to absolve physicians from potential liability for allowing patients to drive when they were not capable or for the ability of the patient to make the decision for themselves.[1,2,4,5,7]

Knee Arthroscopy

Like arthroplasty, rates of arthroscopic knee procedures in the United States and worldwide are increasing. In 2006, nearly 1 million arthroscopic knee procedures were performed in the United States, and more than 127,000 of those were anterior cruciate ligament (ACL) reconstructions.[37]

More than 99% of arthroscopic procedures are performed in the outpatient setting, which presents a unique challenge to orthopaedic surgeons regarding counseling patients about when it is safe to drive again. Despite the number of arthroscopic procedures being performed, Argintar et al[38] found that most surgeons (57%) discussed postoperative driving instructions during preoperative consultation with only half of their patients or less.

The type of arthroscopic procedure is perhaps the most important factor to consider when deciding when a patient can safely drive.[38] Simple procedures, such as diagnostic arthroscopy, partial meniscectomy, chondroplasty, or debridement typically allow an expeditious return to safe driving. Argintar et al[38] suggested that patients undergoing such procedures may resume driving 1 week postoperatively if they are no longer taking narcotic medications. Hau et al[16] compared TBT in 30 patients who underwent partial meniscectomy, chondroplasty, or diagnostic arthroscopy with that of preoperative controls. At 1 week after surgery, mean TBT increased to 920 milliseconds from a preoperative value of 736 milliseconds. This represents an increased stopping distance of 5.2 m in a car traveling at 100 km/h. By 4 weeks postoperatively, mean TBT was 685 milliseconds, which was better than the preoperative assessment. Therefore, they recommended that patients wait at least 1 week to resume driving after right knee arthroscopy.[16]

Compared with simpler arthroscopic procedures, ACL reconstruction typically requires a longer rehabilitation and recovery time; many patients require more than 9 months before resuming sport.[39] Perhaps it is not surprising that studies examining return to driving after ACL reconstruction support a 4- to 6-week recovery time (►**Table 3**).[2,4,14,23] Gotlin et al[14] and Nguyen et al[23] examined BRT after right ACL reconstruction and found that BRT returned to preoperative levels by 6 weeks postoperatively. Wasserman et al[40] examined the effects of three types of ACL grafts on BRT at 1, 3, and 6 weeks postoperatively, compared with nonoperative patients. The authors found that patients who underwent ACL reconstruction with an allograft (tibialis anterior) regained normal BRT by 3 weeks, and patients treated with either autograft (hamstring or bone–patellar tendon–bone) regained normal BRT by 6 weeks postoperatively.[40]

Lower Extremity Trauma

Traumatic injuries to the lower extremity vary greatly in severity. Few studies have addressed return to driving after lower extremity trauma, and the decision must be tailored to the specific injury and degree of impairment (►**Table 4**). Egol et al[12] examined the effect on BRT of an operatively treated right ankle fracture. In their study, 31 patients who underwent ankle open reduction and internal fixation were tested on a driving simulator at 6, 9, and 12 weeks postoperatively, and their results were compared with those of healthy controls. The increased BRT represented a nonsignificant increased stopping distance in a car traveling at 97 km/h of 6.7 m at 6 weeks and 2.4 m at 9 weeks postoperatively. The authors concluded that BRT returned to baseline values by 9 weeks postoperatively.[12]

Egol et al[11] studied the effect on BTT of various types of articular and long-bone fractures. Patients were categorized into the following three groups: healthy controls ($n = 12$), long-bone fractures ($n = 22$: 9 femur, 13 tibia), and articular fractures ($n = 35$: 12 calcaneus, 12 plateau, 7 acetabulum, and 4 pilon). The authors found that BTT was significantly increased in all groups until 6 weeks after resuming full weight bearing. Thereafter, most patients' BTT had returned to baseline, allowing them to drive safely.

A recent study by Ho et al[41] examined patients' ability to drive safely after surgical treatment of right ankle fractures. The authors assessed this by using BRT, the short musculoskeletal functional assessment, and an on-road driving test with a driving instructor if they met minimum criteria in simulated BRT and short musculoskeletal functional

Table 3 Return-to-driving recommendations after arthroscopic knee surgery

First author	Year	Procedure	Evaluation method	Recommendations/findings	
				Left knee	Right knee
Nguyen[23]	2000	Anterior cruciate ligament reconstruction	BRT	2 weeks	6 weeks
Gotlin[14]	2000	Anterior cruciate ligament reconstruction	BRT		4–6 weeks
Hau[16]	2000	Partial meniscectomy, chondroplasty, diagnostic scopes	BRT		≥1 week
Lewis[77]	2011	Partial meniscectomy, chondroplasty, diagnostic scopes	Survey		1 day to ≥3 weeks
Argintar[38]	2013	Partial meniscectomy, chondroplasty, debridement	Survey		1 week
Wasserman[40]	2017	Anterior cruciate ligament reconstruction	BRT		3 weeks after tibialis anterior allograft; 6 weeks after hamstring and BPTB autograft

Abbreviations: BPTB, bone–patellar tendon–bone; BRT, brake reaction time.

Table 4 Return-to-driving recommendations after trauma to the right lower extremity

First author	Year	Procedure	Evaluation method	Recommendations/findings
Egol[12]	2003	Ankle ORIF	BRT	9 weeks
Egol[11]	2008	Tibia or femur intramedullary nailing	BRT	12 weeks (6 weeks after full weight bearing)
Egol[11]	2008	Acetabulum, tibial plateau, pilon, calcaneus ORIF	BRT	18 weeks (6 weeks after full weight bearing)
Yousri[26]	2015	Operative and nonoperative ankle fractures	BRT	8 days after cast removal
Ho[41]	2018	Ankle ORIF	BRT and SMFA	6 weeks

Abbreviations: BRT, brake reaction time; ORIF, open reduction and internal fixation; SMFA, short musculoskeletal functional assessment.

assessment testing. Compared with the findings of Egol et al,[12] they found that patients can safely resume driving at 6 weeks postoperatively, even before weight bearing is initiated.

Upper Extremity

Upper Extremity and Driving

There are no specific guidelines for safe return to driving after immobilization or surgery for injuries or chronic conditions of the upper extremity. Whereas BRT is commonly used to gauge when it is safe to resume driving after lower extremity surgery, no similar metric exists for the upper extremity. Thus, orthopaedic surgeons rely on their own judgment or anecdotal experience rather than evidence-based clinical guidelines.[1] This creates varying opinions on and protocols for determining when it is safe to resume driving (►**Table 5**).[42–46]

When considering surgeries to the upper extremity, the specific area of involvement and the type of condition being treated influence when it is safe to resume driving. Each joint in the upper extremity contributes to the motion and strength needed to operate the gear shift and the steering wheel. In a study by Liu et al,[47] patients used a driving simulator while undergoing electromyography, showing that several shoulder muscles are essential in clockwise and counterclockwise steering maneuvers. The authors found that only small degrees of motion at the shoulder could produce large changes in steering direction. Rawal et al[48] performed a study using motion analysis of joint biomechanics during driving and determined that shoulder flexion and rotation, as well as forearm pronation and supination, were the most important factors in safe driving. The mean ranges of shoulder motion needed for hazard avoidance were 20 to 48 degrees of shoulder flexion and 2.1 to 26 degrees of internal rotation. The mean ranges of forearm motion needed for hazard avoidance were 7.2 degrees of supination to 62 degrees of pronation.[30]

Upper Extremity Immobilization

After upper extremity surgery, immobilization protects the limb or joint from excessive stress. Unfortunately, this can lead to prolonged loss of motion, loss of function, and impaired ability to drive safely. Immobilization devices used in the upper extremity include casts, splints, braces, and slings. The appropriate application of these devices is important to gain maximum benefit from surgery.[49]

The shoulder has a large range of motion and thus is typically able to compensate when performing tasks that

Table 5 Return-to-driving recommendations after upper extremity surgery

First Author	Year	Procedure	Evaluation method	Recommendations/findings
Acharya[76]	2005	CTR	Survey	Resume driving safely at 9 days; patients with bilateral CTRs took longer to resume driving
Hammert[75]	2012	Outpatient hand soft tissue surgery	Survey	50% of patients drove immediately after surgery; remaining drove within 1 week
Hasan[45]	2016	TSA and rTSA	Driving simulator	Recommend 6–12 weeks
Hasan[44]	2016	Arthroscopic RCR and labral repair	Driving simulator	Return to preoperative driving function at 12 weeks
Jones[53]	2017	Distal radius ORIF	Closed course driving examination	3 weeks

Abbreviations: CTR, carpal tunnel release; ORIF, open reduction and internal fixation; RCR, rotator cuff repair; rTSA, reverse total shoulder arthroplasty; TSA, total shoulder arthroplasty.

require upper extremity coordination and movement during periods of immobilization of the upper extremity. Flexion and rotation are important for steering, and limiting these motions via immobilization impairs driving ability.[47] Hasan et al[50] found that immobilization of the shoulder in a sling decreases driving performance and the ability to perform evasive maneuvers during hazardous conditions. Patients should be informed that driving with an immobilized arm can result in further injury to themselves or others.

Immobilization from the forearm to above the elbow, such as with a long-arm cast, significantly inhibits the ability to drive safely[27,51,52] by diminishing pronation and supination (more so than elbow flexion and extension[48]). Therefore, few patients drive with above-the-elbow immobilization. However, most patients who drive with upper extremity immobilization are those in short-arm casts with the elbow free.[51] This discrepancy is caused by the fact that short-arm casts and splints are the most common type of upper extremity immobilization and have been deemed safe to use while driving.[43]

Wrist immobilization is considered to allow safe driving but only when grip strength is preserved.[43] Devices that limit grip strength, such as thumb spica casts, have been shown to increase perceived driving difficulty. Jones et al[53] showed that patients wearing a thumb spica cast made more mistakes during test drives on a simulated driving circuit.[43] The influence of laterality is unclear because studies show mixed results when determining whether immobilization of the right versus left is more impairing.[42,43] Finally, finger immobilization should not affect one's ability to drive if grip strength is preserved.

Shoulder Arthroplasty

Anatomic and reverse total shoulder arthroplasty improve pain and functional outcomes in patients with various degenerative shoulder conditions.[54,55] The number of shoulder arthroplasty continues to increase given the demands of an aging population, advances in shoulder-specific arthroplasty training, and improvements in implant technology and availability.[56] The mean age of patients undergoing shoulder arthroplasty is approximately 70 years, which is an age at which many adults are still driving.[57]

It is considered unsafe to drive during the immediate period after shoulder arthroplasty when most patients' shoulders are immobilized in a brace or sling and patients are often taking narcotic medicine for pain.[58,59] There is less agreement about the safety of driving after shoulder immobilization and narcotic medicine have been discontinued. Using a driving simulator, Hasan et al[44] tested 30 patients after shoulder arthroplasty and found that driving function was at least equivalent to preoperative values at 6 weeks postoperatively. By 12 weeks, driving ability was better than preoperative values because of reduced pain, increased range of motion, and better shoulder function. The authors concluded that patients could drive safely between 6 and 12 weeks after shoulder arthroplasty.[44] Muh et al[60] found that 12 of 31 of patients had resumed driving within 1 month after total shoulder arthroplasty, whereas 29 of 31 resumed driving within 3 months after surgery.

Shoulder Arthroscopy

Similar to shoulder arthroplasty, the number of arthroscopic shoulder surgeries is also increasing,[61] including rotator cuff repairs, labral repair, biceps tenodesis, and subacromial decompression.[62–66] Patients may require 1 day to 4 months to resume driving after rotator cuff surgery.[67] Meanwhile, patients who undergo subacromial decompression, without rotator cuff repair, return to driving within a mean of 1 month postoperatively.[68] One study found impaired driving performance for at least 6 weeks after arthroscopic rotator cuff or labral repair when using a validated driving simulator; driving ability did not return to preoperative levels until approximately 12 weeks postoperatively.[45]

Decreased driving performance after arthroscopic shoulder surgery is caused by temporary muscle weakness, pain, and stiffness. Patient surveys after arthroscopic shoulder surgery show that pain and weakness are the primary factors that make patients feel unsafe to drive because of increased difficulty in steering.[67] One prospective study reported that approximately half of patients (81 of 166) who underwent arthroscopic rotator cuff repair had activity-limiting stiffness and weakness at 6 weeks postoperatively.[69] Another prospective study found that 43% of patients (19 of 44) who underwent arthroscopic rotator cuff repair had pain for at least 6 weeks after surgery.[70]

Hand and Wrist Surgery

Surgery on the hand or wrist can affect driving in several ways. Patients may experience loss of grip strength because of immobilization and pain and loss of motion and function associated with the procedure itself. Although a large portion of the wrist's total arc of motion is used while driving, this high degree of wrist motion correlates to only small changes in steering wheel position.[48] Therefore, the wrist's contribution to steering wheel maneuvering is minimal.

The incidence and operative treatment of distal radius fractures and carpal tunnel syndrome have increased during the last several decades,[71–73] making them among the most common surgeries performed on the hand and wrist.[73,74] Jones et al[53] conducted a prospective trial with 23 patients and determined that most patients who underwent open reduction and internal fixation via volar plating of the distal radius could drive safely at 3 weeks postoperatively. The authors concluded that postoperative pain was a major factor that limited safe driving.

Minimally invasive surgeries of the hand and wrist appear to have less deleterious effects on driving, and, as a result, the return-to-driving time is typically less than that associated with other upper extremity surgeries. Hammert et al[75] found that half of patients (69 of 139) who underwent minimally invasive procedures, of which most involved only soft tissue and were performed on an outpatient basis, were able to drive immediately after surgery. Included were carpal tunnel releases, annular one pulley releases, mucous cyst excisions, ganglion cyst excisions, first dorsal compartment releases, foreign body removals, and amputations. In a prospective study, Acharya et al[76] found that approximately half of 75 patients who underwent open carpal tunnel release had resumed driving 9 days postoperatively. Notably, patients who underwent simultaneous bilateral carpal tunnel release took significantly longer to resume driving compared with those who underwent unilateral carpal tunnel release.

Surgeries and injuries to the upper extremity are common, and treatment modalities can affect one's ability to drive safely. Research on the topic suggests that injuries involving the shoulder and elbow appear to limit driving more so than those involving the midforearm, wrist, and hand. Additionally, it takes longer to resume safe driving after shoulder surgery compared with other upper extremity surgeries. The establishment of return-to-driving guidelines would be helpful for surgeons and patients and should be based on current and future studies.

Conclusion

Many factors must be considered when counseling patients about when to resume driving after orthopaedic surgery. These factors include the following: whether surgery was performed on the upper or lower extremity, use of narcotic medications, whether surgery was performed on the dominant arm or braking leg, the type of surgical procedure, whether the limb is immobilized or in a brace, the amount of pain the patient is experiencing, the patient's range of motion and muscle strength, and the ability of the patient to control the vehicle. Studies have provided some data on the length of time it takes to recover from orthopaedic surgery to a degree that allows safe driving. Ultimately, this decision requires consideration of all of these variables and an informed discussion with the patient. The decision to resume driving should be made on a case-by-case basis.

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