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The Newsletter on Musculoskeletal Medicine

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Outcomes in Suprapatellar Nailing Versus Infrapatellar Nailing of Tibia Fractures

CME Article by Ellen Hoffmeister

Ms. Hoffmeister is a freelance medical writer in Camp Hill, Pennsylvania.

The author, faculty, and staff in a position to control the content of this CME activity have disclosed that they have no financial relationships with, or financial interests in, any commercial organizations relevant to this educational activity.

Learning objective: After completing this activity, physicians should be better able to compare outcomes with suprapatellar nailing vs. infrapatellar nailing of tibia fractures.

Key Words: Fractures, Tibia, Nailing

In a recent systematic review, researchers assessed the effect of suprapatellar (SP) nailing vs. infrapatellar (IP) nailing of tibia fractures in anterior knee pain, complications, physical functioning, and quality of life (QoL). (See Bleeker et al., 2021.)

Nils Jan Bleeker, MD, of the Department of Orthopaedic Trauma Surgery at University Medical Center

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Malnutrition, Severe Vitamin D Deficiency Risk Factors for Postoperative Complications in Older Adults After Orthopaedic Surgery

CME Article by Ellen Hoffmeister

Ms. Hoffmeister is a freelance medical writer in Camp Hill, Pennsylvania.

The author, faculty, and staff in a position to control the content of this CME activity have disclosed that they have no financial relationships with, or financial interests in, any commercial organizations relevant to this educational activity.

Learning objective: After completing this activity, physicians should be better able to evaluate the extent to which malnutrition and vitamin deficiency impact outcomes in geriatric patients undergoing elective orthopaedic surgery.

Key Words: Vitamin D, Elders, Malnutrition

In a retrospective analysis, researchers found that geriatric patients with malnutrition undergoing elective

orthopaedic surgery showed a higher rate of reoperation, exhibited more wound-healing disorders, and experienced more Clavien-Dindo Grade IV complications than their healthier peers. (See Meyer et al., 2021.)

In addition, researcher Matthias Meyer, MD, of the Department of Orthopedic Surgery at Regensburg University Hospital, Bad Abbach, Germany, and colleagues report that a deficiency of vitamin D in geriatric patients led to a higher rate of postsurgical of falls.

Meyer et al. note there is growing evidence that malnutrition (from studies primarily focusing on hypoproteinemia) is an important risk factor for adverse

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Outcomes in Suprapatellar Nailing

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Groningen, University of Groningen in the Netherlands, and colleagues report that their review does not reveal the superiority of either technique in any of the outcomes reviewed.

Bleeker et al. write that, before their review, the most recent review on this subject was published in 2019 and concluded that the SP approach resulted in less pain and better functional outcomes than the IP approach. They add that since that time, several more good-quality studies reporting on pain, complications, physical functioning, and general QoL were published on the two approaches.

Their current analysis provides an update to the previous review, with inclusion of these additional studies. The researchers' aim was to determine whether the SP vs. the IP approach results in less anterior knee pain, influences complication rates, and affects physical functioning and QoL.

How Did Researchers Conduct the Review?

Bleeker et al. searched the PubMed and Embase databases for articles published between 2010 and 2020 relating to tibia fractures, intramedullary nailing (IMN), SP nailing, and IP nailing. Eligible studies included randomized controlled trials (RCTs), as well as prospective and retrospective observational studies reporting on tibia fractures; IMN; nailing technique; anterior knee pain; complications (e.g. retropatellar chondropathy, infection, malalignment, nonunion, subsequent surgical procedures, and range of motion [ROM]); and physical functioning and QoL.

Eligible studies also assessed patient-reported outcome measures (PROMs), had a minimal follow-up of six months, and included patients 18 years or older.

Excluded were studies addressing pediatric fractures, animal studies, case reports, conference abstracts, systematic reviews or meta-analyses, surgical treatment other than IMN, and studies published in languages other than English, German, Dutch, French, and Spanish.

Bleeker and another member of the research team independently assessed the methodological quality and risk of bias, according to the guidelines of the McMaster University Occupational Therapy Evidence-Based Practice Research Group. The McMaster critical appraisal consists of eight categories, including study purpose; literature review; study design; study sample; study outcome; study intervention; study results; and conclusions and implications.

Data extraction (including patient demographics, study details, Arbeitsgemeinschaft für Osteosynthesefragen/Orthopaedic Trauma Association [OTA/AO] classification, follow-up duration, and outcome measures of interest) was performed independently by two of the researchers.

Outcome Measures

Bleeker et al. defined anterior knee pain as discomfort located anteriorly of the affected knee, which occurred after tibia nailing. They presented anterior knee pain as a percentage of patients experiencing knee pain or as objectified with use of PROMs. Patient-reported outcome measures encompassed multiple questionnaires reporting on the two predefined constructs (i.e. physical functioning and QoL). Retropatellar chondropathy was defined as

The continuing education activity in Lippincott's Bone and Joint Newsletter is intended for health care professionals interested in the practice of musculoskeletal medicine.



Wolters Kluwer *Lippincott's Bone and Joint Newsletter* (ISSN 1543-9879), formerly *The Joint Letter*, is published 11 times a year by Wolters Kluwer Health, Inc. at 14700 Citicorp Drive, Bldg 3, Hagerstown, MD 21742. **Customer Service:** Phone (800) 638-3030; Fax (301) 223-2400; E-mail: customerservice@lww.com. Visit our website at LWW.com. Publisher, Sharon Zinner.

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SUBSCRIPTION RATES: *Individual:* US \$314, international \$428. *Institutional:* US \$839, international \$1031. *In-training:* US \$169, international \$169. **GST Registration Number:** 895524239. Send bulk pricing requests to Publisher. **Single copies:** \$95. **COPYING:** Contents of *Lippincott's Bone and Joint Newsletter* are protected by copyright. Reproduction, photocopying, and storage or transmission by magnetic or electronic means are strictly prohibited. Violation of copyright will result in legal action, including civil and/or criminal penalties. Permission to reproduce in any way must be secured in writing; go to the newsletter website (www.lbjnewsletter.com), select the article, and click "Request Permissions" under "Article Tools," or e-mail customer-care@copyright.com. **Reprints:** For commercial reprints and all quantities of 500 or more, e-mail reprintsolutions@wolterskluwer.com. For quantities of 500 or under, e-mail reprints@lww.com, call (866) 903-6951, or fax (410) 528-4434.

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iatrogenic damage to the patellofemoral joint after SP nailing detected by preoperative arthroscopy and postoperative MRI of the knee. Infections were categorized into superficial and deep infections and encompassed septic arthritis.

The researchers divided malalignment into angular deformities in the coronal or sagittal plane and rotational malalignment. Angular deformities were defined as a deformity of 5 degrees or more in the coronal or sagittal plane; rotational malalignment was defined as a rotation of 10 degrees or more in comparison to the unaffected side.

Nonunion included no signs of cortical healing after six months. Subsequent surgical procedures included screw removal, implant removal, and revision for complications. Range of motion was extracted as reported in included studies and comprised the flexion and extension of the affected or/and unaffected knee joint.

What Results Do Researchers Report?

The literature search resulted in 201 articles, of which 25 full-text articles were screened. A total of 14 studies met the inclusion criteria and were eligible for further analysis. Of these, nine were comparative studies and four were noncomparative studies reporting on either the SP or IP approach. Bleeker et al. add that there were two RCTs, one prospective single cohort study, seven retrospective comparative cohort series, and four retrospective single cohort series.

A total of 1447 patients were included in the systematic review, including 760 fractures treated with the SP approach and 700 fractures treated with the IP approach.

Anterior Knee Pain

Eight studies reported on anterior knee pain, including six comparative studies and two noncomparative studies. The weighted incidence of anterior knee pain was 29% after the SP approach (range 0%–38%) and 39% after the IP approach (range 14%–46%). No substantial differences were reported on visual analog and numeric rating scales, and Hospital for Special Surgery (HSS) and Lysholm pain scores for either approach.

Best-evidence synthesis showed that five of eight studies that reported on knee pain were of good or excellent quality.

Complications

Two studies reported on retropatellar chondropathy after the SP approach.

Eight studies reported on infection, including three of good and two of excellent quality. The weighted infection rate was 12% after the SP approach (range 0%–18%) and 9% after the IP approach (range 0%–20%), with most infections occurring after nailing of open fractures (SP: 18% vs. IP: 14%).

Seven studies reported on alignment, including five good- and excellent-quality studies. Regarding complications, only the rate of malalignment was significantly different (4% vs. 26%), with small absolute differences in the coronal and sagittal plane in favor of the SP approach.

Three studies reported on fracture healing, including one good-quality and one excellent-quality study. The incidence of nonunion based on measurements on plain radiographs ranged from 1% to 9% after SP nailing. This incidence was 0% after IP nailing and did not statistically differ between the SP and IP approaches.

Eight studies reported on subsequent surgical procedures, of which six were of good to excellent quality. The weighted rate of subsequent surgical procedures was 21% after the SP approach (range 3%–48%) and 26% after the IP approach (range 0%–62%). None of the comparative studies showed significant differences in rates of subsequent surgical procedures.

Only one study reported a significant difference between ROM preoperatively and postoperatively at last follow-up after the SP approach (26.7 vs. 117.9 degrees). Other studies reported no substantial differences in knee ROM between the affected and unaffected sides at clinical follow-up.

Physical Functioning and General Quality of Life

Ten studies reported on physical functioning of the knee, of which five studies were of good or excellent quality. Only one study determined a statistically significant difference in Lysholm scores after 12 months between the SP and IP approaches (standardized mean difference

[SMD], 0.6). Bleeker et al. report no differences, with almost equal outcomes for the SP and IP approaches in the International Knee Documentation Committee, Oxford Knee, Kujala Knee, HSS, Olerud-Molander Ankle, and Irrgang scores.

Four studies reported on general QoL, including two studies with good or excellent methodological quality. No relevant differences were observed in 36-item Short Form Survey (SF-36) and SF-12 scores between the SP and IP approaches.

What Strengths and Limitations Do Researchers Point Out?

Bleeker et al. write that this is the first review that encompassed the complete spectrum of outcome measures after SP and IP nailing. They add that the search criteria were not limited by study design, which provides a complete overview of all outcomes of interest published over the last decade. Lastly, this study provides a clinically question-driven overview about the ongoing debate on the nailing technique of tibial fractures.

They also note that because of heterogeneity, inconsistent time points, and a varying range of methodological quality, a pooled analysis was not possible. However, they state that the results presented in the study were not subjected to any form of heterogeneity and were therefore validated and statistically reliable.

The researchers write that the two approaches are both good techniques in tibial nailing, with comparable results in anterior knee pain, complication rates, physical functioning, and QoL. They state that the definitive choice of treatment should depend on the surgeon's experience and available resources. ■

Conflicts of interest: None declared

Reference

Bleeker NJ et al., Difference in pain, complication rates, and clinical outcomes after suprapatellar versus infrapatellar nailing for tibia fractures? A systematic review of 1,447 patients, *Journal of Orthopedic Trauma*, 2021; 35:391-400.

The rate of malnutrition was 11% and the rate of vitamin D deficiency 49% (with 20% of patients being severely vitamin D deficient).

Malnutrition, Severe Vitamin D

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events after surgery. However, less is known about the impact of vitamin D deficiency in the context of orthopaedic surgery. In their study, they evaluated the prevalence and impact of malnutrition and vitamin deficiency in geriatric patients undergoing elective orthopaedic surgery.

Who Was Included and What Methods Did Researchers Employ?

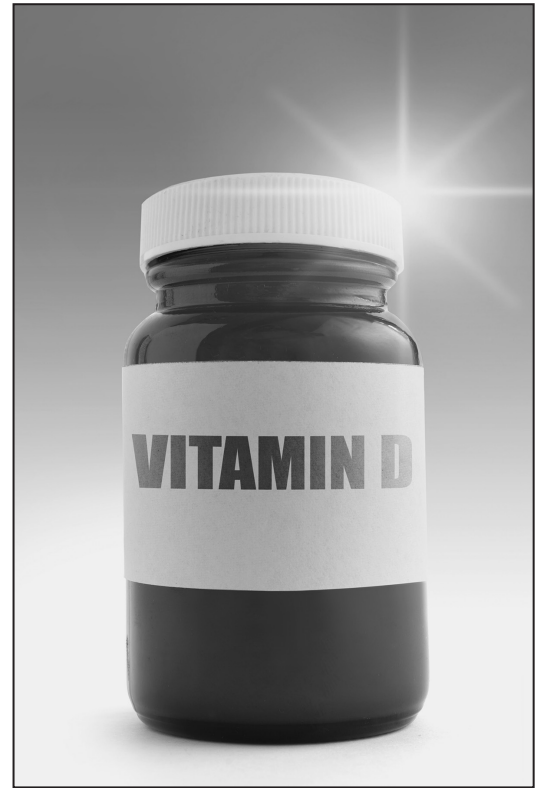
All operations took place at the Department of Orthopedic Surgery of University Hospital Regensburg between January 2018 and December 2019. The researchers explain that all geriatric patients undergoing elective orthopaedic surgery had serum levels for total protein, vitamin D, vitamin B₁₂, and folate measured as part of their preoperative blood investigations.

Meyer et al. defined geriatric patients as those older than 65 years with typical geriatric comorbidity or those older than 80 years. All patients with complete preoperative laboratory findings and postoperative medical records were included in the study.

Study endpoints included reoperation within 90 days after surgery, readmission within 90 days, complications, and transfusion rates. Complications were categorized into surgical (e.g. wound healing disorder, iatrogenic fracture, and mechanical complications), internal (e.g. myocardial infarction, acute heart failure, cardiac arrhythmias, pneumonia, and renal failure), and other complications (e.g. deep vein thrombosis, pulmonary embolism, falls, and delirium).

Furthermore, complications were categorized according to the Clavien-Dindo classification, which ranks complications into five grades, based on the therapy used for correction. In this classification system, deviation from the normal postoperative course without the need for pharmacological treatment or surgical, endoscopic, and radiological intervention represents a Grade I complication. Grade II complications require specific pharmacological treatment, whereas Grade III complications result in surgical, endoscopic, or radiological intervention. Grade IV complications are defined as life-threatening events requiring intensive care management. Grade V represents the death of a patient.

Meyer et al. defined malnutrition as total serum protein less than 6.0 g/dL. Vitamin D deficiency was defined as serum 25-OH-D level less than 20 ng/mL; a serum 25-OH-D level less than 12 ng/mL was defined as severe deficiency. They defined serum cobalamin level less than 200 ng/L as vitamin B₁₂ deficiency, whereas a level of 200 to 300 ng/L was defined



as insufficiency. Folate deficiency was defined as serum folate level less than 2 ng/mL, with levels between 2 and 4 ng/mL were defined as insufficiency.

Laboratory findings were extracted from the hospital's information system. The researchers obtain additional available data from the hospital's clinical information system on patients' age, sex, length of stay, operative procedure, transfusion, transfer to intensive care unit, reoperation, readmission, and complications, as well as principal and secondary diagnoses at the time of hospitalization (including corresponding *International Classification of Diseases, Tenth Revision [ICD-10]* codes).

The Hospital Frailty Risk Score (HFRS) was calculated retrospectively for each patient, based on the available *ICD-10* codes entered for the time of admission. The researchers defined frailty as an HFRS above or equal to 5.

What Do Researchers Report?

Meyer et al. report that 599 geriatric patients underwent orthopaedic surgery during the study period. The rate of malnutrition was 11% and the rate of vitamin D deficiency 49% (with 20% of patients being severely vitamin D deficient). Patients with insufficiency or deficiency of vitamin B₁₂ and folate, respectively, were pooled for further statistical analysis.

The malnourished cohort showed a higher reoperation rate (13% vs. 5.5%; $P = 0.01$) and exhibited more Clavien-Dindo Grade IV complications (7.4% vs. 2.4%; $P = 0.03$) than the cohort with normal parameters. Malnourished patients also had higher rates for readmission

(8.8% vs. 5.5%; $P = 0.3$) and transfusion (8% vs. 4%; $P = 0.09$). These patients also exhibited more surgical (16% vs. 9.0%; $P = 0.06$), other (12% vs. 7.6%; $P = 0.2$), and internal complications (7.4% vs. 3.6%; $P = 0.1$) than normally nourished patients, but not to a significant degree. Yet, among surgical complications, the frequency of wound-healing disorders was significantly higher in patients with malnutrition (7.4% vs. 1.3%; $P = 0.001$).

Patients with severe vitamin D deficiency exhibited more other complications (13% vs. 6.7%; $P = 0.02$) than patients with higher serum levels. The researchers note that this was due to a higher rate of falls (8.4% vs. 2.9%; $P = 0.006$) in the severely vitamin D-deficient cohort. Severely vitamin D-deficient patients also showed a higher rate of delirium (5.9% vs. 3.1%; $P = 0.2$) than patients with higher serum levels, but the increase was not statistically significant.

Insufficiency or deficiency of vitamin B₁₂ and folate was found in 24% and 11% of patients, respectively. However, insufficiency or deficiency of vitamin B₁₂ and folate neither affected reoperation rate nor rates of readmission, complications, and transfusion.

The proportions of patients with frailty (59% vs. 40%; $P = 0.004$) were higher in the malnourished cohort. Despite its correlation to frailty, multivariable regression analysis identified malnutrition as an independent risk factor for reoperation (odds ratio [OR], 2.6; 95% confidence interval [CI], 1.1–6.2) and wound-healing disorders (OR, 7.1; CI, 1.9–26). Moreover, severe vitamin D deficiency was identified as an independent risk factor for falls (OR, 3.1; CI, 1.3–7.6).

What Do Researchers Add About Findings?

These researchers note, that to their knowledge, this is the first study to evaluate a possible correlation between deficiency of vitamin B₁₂ and folate and adverse events after orthopaedic surgery. In contrast to hypoproteinemia and severe vitamin D deficiency, deficiency of vitamin B₁₂ and folate had no impact on the risk of adverse events after orthopaedic surgery.

They reiterate their finding of a statistically significant correlation between malnutrition

and postoperative adverse events. Malnourished patients were six times more likely to suffer from wound-healing disorders and showed a threefold increased rate of complications requiring ICU management. The risk of reoperation and transfusion was increased more than twofold for patients with malnutrition. "Taken together, the findings of our study are consistent with existing literature and emphasize the importance of malnutrition as a risk factor for adverse events after orthopaedic surgery," they write.

They also note that severe vitamin D deficiency led to a twofold increase in falls, with multivariable analysis identifying severe vitamin D deficiency as an independent risk factor for falls in patients undergoing orthopaedic surgery. However, the results provide little other evidence that severe vitamin D deficiency is a risk factor for adverse events after orthopaedic surgery.

Meyer et al. recognize several study limitations that are consistent with most database studies. Data acquisition was limited to that available from the hospital information system. Due to the retrospective study design, the results are susceptible to selection bias. Furthermore, other parameters with possible influence on postoperative outcome, such as body mass index and psychosocial aspects, could not be captured.

Yet, despite these limitations, they state that the study demonstrates the relevance of malnutrition in geriatric patients undergoing elective orthopaedic surgery. Due to the high rate of malnutrition and its negative effects on postoperative outcome, they suggest that a systematic screening of geriatric patients undergoing elective orthopaedic surgery should be applied. "As malnutrition is considered a modifiable risk factor, future research should focus on the effects of preoperative nutritional intervention in a prospective randomized setting," they conclude. ■

Conflicts of interest: None declared.

Reference

Meyer M et al., Impact of malnutrition and vitamin deficiency in geriatric patients undergoing orthopaedic surgery, *Acta Orthopaedica*, 2021; 92(3):358–63.

Despite these limitations, the authors state that the study demonstrates the relevance of malnutrition in geriatric patients undergoing elective orthopaedic surgery.

Coming Soon

- Decompression Alone Not Inferior to Decompression and Instrumented Fusion in Lumbar Spondylolisthesis
- Risk of Falls and Fractures With Antipsychotic Drugs and Cholinesterase Inhibitors Use
- Lymphoma and Rheumatoid Arthritis

Perspective

Study Examines Optimal Surgical Timing for Pediatric Supracondylar Humerus Fractures

Patients who were operated within the first 12 hours (early) or after 12 hours (late) from their admission to surgery were compared with the aforementioned parameters.

In a recent study, Turkish researchers explored the optimal surgical timing for Gartland type III pediatric supracondylar humerus fractures (SHFs). (See Okkaoglu et al., 2021.)

Mustafa Caner Okkaoglu, MD, of the Department of Orthopaedics and Traumatology, University of Health Sciences, at Ankara Kecioren Training and Research Hospital, and colleagues report that there may not be an interval that makes a difference in outcomes for patients, as long as the surgery is performed within the first 24 hours.

The researchers note that although the methods used in the surgical treatment of pediatric SHFs have been clearly described, there is controversy about the timing of the surgery. For example, delayed surgical intervention can lead to swelling around the elbow, which may cause difficulty during closed reduction of the fracture. "While some authors suggest operating the SHF as soon as possible, some authors recommend operating on these fractures within working hours after providing favorable conditions for both surgeon and non-surgeon factors," they write.

Study Design

In their study, Okkaoglu et al. evaluated the effect of early (within 12 hours of admission) or late (12 hours or more after admission) surgical interventions; surgical procedures performed during "working hours" (i.e. between 8:00 AM and 5:00 PM) or "nonworking hours" (i.e. between 5:00 PM and 8:00 AM); and operative parameters (e.g. operative duration and open reduction rate, reduction quality on postoperative early radiographs) on pediatric SHFs.

Okkaoglu et al. retrospectively reviewed patients who underwent surgery for Gartland type III SHFs at their hospital between January 2011 and January 2019. Open fractures, fractures associated with vascular injury and compartment syndrome, and flexion-type fractures were excluded. One hundred-fifty patients met the inclusion criteria and were included in the study.

The researchers explain that there is not a separate operating room for trauma cases at their hospital. Therefore, SHF patients may undergo surgery on the night of their admission or the next day, but all within the first 24 hours. Operations are performed by a senior orthopaedic surgeon, accompanied by one or two residents. The researchers add that during non-working hours, less experienced orthopaedic



staff work with the surgeon in their operating room.

Study Groups

Study patients were divided into two groups: those who underwent surgery during working hours and those who underwent surgery during nonworking hours. The researchers collected information on patient age and sex, time from admission until surgery, operative duration, and open reduction rates from the hospital registry notes. Operative duration was defined as the time between the administration and discontinuation of anesthesia.

Reduction quality was assessed with lateral capitellohumeral angle (LCHA), Baumann angle, and anterior humeral line in early postoperative radiographs. The normal range of LCHA was between 22 and 70 degrees; Baumann angle normal range was between 56 and 86 degrees. If the anterior humeral line passed the mid-third of the capitellum, it was considered perfect reduction. If the anterior humeral line passed the capitellum but outside of mid-third, it was considered acceptable reduction. Those that did not pass the capitellum were considered poor reduction.

Nonworking hours were divided into two intervals: between 5:00 PM and 12:00 AM (night) and 12:00 AM and 8:00 AM (late night). Study patients in these subgroups were compared with patients operated on during working hours. In addition, patients who were operated within the first 12 hours (early) or after 12 hours (late) from their admission to surgery were compared with the aforementioned parameters.

Results

Okkaoglu et al. report that 79 patients with Gartland type III SHF were operated on

within working hours and 71 were operated on during nonworking hours. Statistically, there was no difference in age and sex distribution of the 150 patients.

Open reduction rate, mean operation duration, and reduction quality from early postoperative radiographs were similar between working hour and nonworking hour surgical procedures ($P > .05$). However, the mean time from admission until surgery was longer in the working, late, and daytime surgery groups than in nonworking hour, early, and nighttime surgery groups ($P < .001$).

Discussion and Limitations

Okkaoglu et al. note that there are studies in the literature that have investigated the optimal surgical timing in other trauma fields besides SHFs. Three studies cited by the researchers reported higher complication rates during cases performed at night.

However, the current study reports similar operative parameters on pediatric SHFs operated in the daytime or nighttime, as well as late nighttime. "As all the surgeries were performed by a senior orthopedic surgeon and an accompanying one or two residents in our institution regardless of time interval, we believe that performing the surgery as a team may have compensated the less experienced staff's impact on the surgery at night and late-night intervals," they write. This, they state, may be the reason that there was no difference on operative parameters during the 8:00 AM and 5:00 PM interval, vs. the other intervals.

They also found no effect of the surgical timing on reduction quality. "We believe that

success at reduction quality is multifactorial and surgical timing is only one of the factors. Different operating room settings, level of experience of operating team and staff, and patient-dependent factors such as age, initial swelling of the elbow, obesity, and mechanism of the injury may all have an impact on achieving satisfactory reduction," they write.

The researchers did not observe any difference in reduction quality, open reduction rate, or operative duration in patients who were operated in the first 12 hours or after 12 hours. All the patients were operated within the first 24 hours, which they state may be the reason for the similar outcomes at different intervals.

Okkaoglu et al. note that one limitation of their study is its retrospective design, thus randomization of the patients into intervals was absent. Second, all surgical procedures were not performed by the same surgeon. "Surgical exposures and pin configurations during fixation were not taken into consideration in the study, which may have had an impact on the results," they write. They conclude that further controlled studies evaluating the short- and long-term outcomes are needed to define the optimal timing of pediatric SHFs. ■

Conflicts of interest: None declared.

Reference

Okkaoglu MC et al., Is there an optimal timing for surgical treatment of pediatric supracondylar humerus fractures in the first 24 hours? *Journal of Orthopaedic Surgery and Research*, 2021; 16:484.

Trends and Innovations

Physiotherapy-Led Screening Effective for Patients Seeking Orthopaedic Care

In a pilot study, Canadian researchers found that physiotherapy-led screening of electronic medical records (EMRs), using a locally developed screening tool, is beneficial in identifying whether patients required orthopaedic intervention or conservative management, provided that those who receive conservative management are monitored to ensure they access orthopaedic services, if warranted. (See Pike et al., 2021.)

Captain Mallory Pike, MSc, Senior Practice Leader of Primary Care Nursing Services for the Canadian Armed Forces in Halifax, Nova Scotia,

and colleagues write those patients can wait up to 14.6 weeks from referral by their general practitioner to consultation with an orthopaedic surgeon, and up to 24.5 weeks from orthopaedic consultation to treatment.

Further contributing to the demand for orthopaedic services is the high proportion of patients with musculoskeletal conditions referred to orthopaedic surgery for whom conservative management may be more appropriate. "Research indicates that 37% to 42.7% of patients referred to orthopaedic surgery could be effectively managed within the primary care

environment, either with physiotherapy or injections, rather than surgery," according to Pike et al.

To improve access, new models of care involving physiotherapists to either diagnose, triage, and/or conservatively manage patients with musculoskeletal disorders are being implemented in Canada.

The researchers state that the purpose of their study was to assess the effectiveness of a screening tool, developed in collaboration with physiotherapists, primary care clinicians, and a subject matter expert in orthopaedic surgery. The screening tool consists of

Pike et al. note that limitations of their study included considering the orthopaedic surgeon as the reference standard.

inclusion and exclusion criteria for referrals, conditions appropriate for surgical consult, and appropriate diagnostic imaging required for each condition before consult.

Their prospective observational study sample was identified by March 31, 2020, and comprised patients scheduled for an orthopaedic consultation for any musculoskeletal condition between April 1 and May 30, 2020, within a military primary healthcare center. The participant selection period was set to allow time for physiotherapists to screen files before an orthopaedic consultation. Patients were excluded if they were referred to orthopaedic surgery by another specialist, no longer a patient of the center, or scheduled after March 21, 2020.

To undergo screening, a patient had to experience no improvement with rehabilitation (including an appropriate active treatment protocol that the patient has been compliant with) when treated by in-house physical rehabilitation services in the past six months; the patient's condition was listed within a compendium of conditions deemed appropriate for surgical consult; and/or imaging evidence of complete rupture of a structure.

Patients who did not have a condition listed in the compendium, had a fracture, and/or experienced a condition more suited for an in-house physiatry referral (e.g. required procedures such as prolotherapy or corticosteroid injection) were excluded from the study.

Results

Referrals for knee (43.9%) and shoulder (19.5%) problems were the most common, followed by hip (12.2%), back (7.3%), ankle (4.9%), leg (4.9%), foot (2.4%), elbow (2.4%), and wrist (2.4%) problems. The majority of the patients (80.5%) were men. In total, 45 patients were scheduled to see an orthopaedic surgeon within the participant selection period; one was excluded because of referral by an orthopaedic surgeon, and three cancelled their appointments.

Before orthopaedic consultations, the EMRs of the 41 patients were independently screened by two randomly assigned physiotherapists. The physiotherapists screened the EMR using the screening tool and provided triage recommendations (i.e. orthopaedic intervention, physiotherapy, physiatry, diagnostic investigations, or other intervention).

The percentage of agreement for triage recommendations among physiotherapists was 78% and interrater agreement was moderate ($\kappa = 0.617$; 95% confidence interval [CI], 0.365–0.868, $P < 0.001$). Excluding recommendations for diagnostic investigations increased the percentage of agreement to 93.9% and resulted in a strong level of interrater agreement ($\kappa = 0.878$; 95% CI, 0.537–1.219). The screening tool was determined to have 64.0% sensitivity,



87.5% specificity, a positive predictive value of 88.9%, and a negative predictive value of 63.2%.

Limitations

Pike et al. note that limitations of their study included considering the orthopaedic surgeon as the reference standard. It is therefore possible that the surgeon decided on surgery as the management plan in certain cases because it was unclear whether the patient had completed an active treatment protocol in physiotherapy, relying instead on subjective reports from the patient.

Further, for the 41 files included, physiotherapists did not once select "other intervention" as a management recommendation, whereas the orthopaedic surgeon recommended this outcome for three patients for whom the surgeon believed no intervention was required. For those three cases, the physiotherapists recommended physiotherapy, suggesting physiotherapists may be more inclined to recommend an active treatment approach, regardless of whether the patient's condition appears to be resolving on its own. Lastly, the small sample size did not allow for calculation of level of agreement per body part.

The researchers recommend that future research should ideally include at least two orthopaedic surgeons and a larger sample size to further evaluate the effectiveness of physiotherapy-led screening of the EMR for patients referred to orthopaedic surgery. ■

Competing interests: None declared.

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Snapshot

Personalized 3D Printed Knee Implant Could Help to Relieve Knee Arthritis

A new treatment that uses three-dimensional (3D) printed implants and that could bring relief to tens of thousands of knee osteoarthritis sufferers has received approval to be studied in patients in the United Kingdom. The study will follow a virtual in-silico trial that demonstrated its safety, according to researchers. (See MacLeod et al., 2021.)

According to a press release, the personalized early knee osteoarthritis treatment, developed by engineers at the University of Bath, Centre for Therapeutic Innovation (CTI), uses state-of-the-art 3D metal printing technology to make personalized medical-grade titanium-alloy plates that perfectly fit every patient. (See University of Bath, 2021.)

Simplifies HTO Surgery

The TOKA (Tailored Osteotomy for Knee Alignment) treatment improves the operative procedure and fit of high-tibial osteotomy (HTO) plates used to realign a patient's knee, making them more stable, comfortable, and better able to bear weight than existing generic plates. The technique also simplifies HTO surgery, making operations quicker and potentially safer.

The HTO plates have already been safety tested virtually, in a computer-based trial using CT scan data from 28 patients. The in-silico clinical trial modeled the stresses that would be exerted on the bespoke plates and showed that they would be comparable in safety to the standard treatment.

3D CT Scan

Knee osteoarthritis patients undergoing TOKA will undergo a 3D CT scan of their knee before a personalized 3D printed surgical guide and plate (both shaped to their tibia) is created. The surgical guide simplifies the surgery and is designed to improve surgical accuracy. The process is also the first implementation of 3D printed screw threads into HTO

plates. This means they can be optimally positioned to help secure them against the bone.

Hospitals in Bath, Bristol, Exeter, and Cardiff will take part in a randomized control study to compare patient outcomes with an existing generic HTO procedure. Tests of the TOKA technique have already begun in Italy, where so far 25 patients received new personalized HTO plates as part of a trial at the Rizzoli Institute in Bologna.

Professor Richie Gill, PhD, from the CTI, states that HTO surgery has a long clinical history and has very good results if done accurately. "The difficulty surgeons have is achieving high accuracy, which is why we have created the TOKA method, which starts with a CT scan and digital plan. 3D printing the custom knee implant and doing the scanning before operating means surgeons will know exactly what they will see before operating and where the implant will go," he says.

Surgical Guide

He notes that a surgical guide (or jig) and a plate implant, each personalized to the patient, can be 3D printed automatically based on the scanning data. "Importantly, this type of treatment relieves the symptoms of knee osteoarthritis while preserving the natural joint," he says. ■

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"Importantly, this type of treatment relieves the symptoms of knee osteoarthritis while preserving the natural joint."

Best of the Rest

Inexpensive Urgent Care Clinics Don't Lower the Costs of Healthcare—They Lead to Additional Medical Visits

Recent years have brought a rapid proliferation of “urgent care centers” in the hope they could treat acute minor health problems such as low back pain, upper respiratory infections, and urinary tract infections at far lower costs than hospital emergency departments (EDs).

There is a general sense among researchers that back care and other low-severity healthcare need to move out of expensive, high-overhead treatment venues such as EDs at major hospitals. Urgent care centers have much lower overheads and lower visit costs.

At first glance, urgent care centers have tremendous potential for reducing costs. A routine ED visit can cost anywhere from \$500 to several thousand dollars depending on the complaint. Some estimates suggest that ED visits cost 10 times those of urgent care center visits.

Unfortunately, a careful new study suggests that urgent care visits do not actually reduce costs. The visit costs are lower. But urgent care centers *increase* the number of people seeking care. And they do not produce an overall reduction in spending. (See Wang et al., 2021.)

“Previous studies have used different approaches to show that urgent care centers reduce emergency department visits for lower acuity conditions,” said senior author Ari Friedman, MD, PhD, assistant professor of Emergency Medicine, Medical Ethics and Health Policy in the Perelman School of Medicine at the University of Pennsylvania. “Our findings confirm ED visits go down, but then show that total costs across both settings actually go up, not down.”

This confirms the suspicions raised in a 2016 study by J.A. Ashwood and colleagues. (See Ashwood et al., 2017.) “These findings [the 2016 study] suggest retail clinics do not trim medical spending but instead may drive it up modestly because they encourage people to use more medical services,” said coauthor Ateef Mehrotra, MD, in a statement from Harvard University. (See Roback, 2016.) He speculated in a subsequent *New York Times* article that urgent care clinics may be attracting the “worried well” as well as sicker individuals. (See Abelson, 2016.)

“Across the twelve years of the study period, researchers found that by 2019, the opening of an urgent care center led to a decline in the number of lower acuity ED visits, and that these ED visits were approximately ten times more expensive than urgent care center visits. Researchers found that the substitution ratio (the number of urgent care visits needed to deter a single ED visit) was high: an increase of 37 urgent care center visits was associated with the substitution of a single lower-acuity ED visit. While urgent care center visits are less expensive than ED visits, it's not enough to offset this difference. Each \$1,646 lower-acuity ED visit prevented was offset by a \$6,327 increase in urgent care center costs,” according to a statement from the University of Pennsylvania.

“We expected urgent care centers to increase access and decrease emergency department visits, but we were surprised by just how many urgent care visits it took to substitute for a lower acuity ED visit,” said lead author Bill Wang.

Friedman pointed out that cost savings should not be the only factor considered when determining where and how to access care. “We should evaluate new care models and interventions on the same standard as we evaluate new drugs—do they improve lives more than they increase costs? That's the important metric. But the cost increases here are so large that the value side of the equation would have to do a lot of work to make it pay off.” ■

Disclosures: None declared.

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Editor's Note: This article was initially published in *Lippincott Williams & Wilkins' The BackLetter*, Volume 36, No. 6 (June 2021).

Lippincott's Bone and Joint Newsletter CME Quiz

To earn CME credit, you must read the CME articles and complete the quiz and evaluation assessment survey on the enclosed form, answering at least 70% of the quiz questions correctly. **Select the best answer and use a blue or black pen to completely fill in the corresponding space on the enclosed answer form.** Please indicate any name and address changes directly on the answer form. If your name and address do not appear on the answer form, please print that information in the blank space at the top left of the page. Make a photocopy of the completed answer form for your own files and send the original answer form to Wolters Kluwer, Continuing

Education Department, PO Box 1543, Hagerstown, MD 21741-9914 by **November 30, 2023**. Only two entries will be considered for credit.

Online quiz instructions: To take the quiz online, **log on to your account at www.lbjnewsletter.com**, and click on the "CME" tab at the top of the page. Then click on "Access the CME activity for this newsletter," which will take you to the log-in page for **<http://cme.lww.com>**. Enter your *username* and *password*. Follow the instructions on the site. You may print your official certificate *immediately*. Please note: Lippincott CME Institute *will not* mail certificates to online participants. **Online quizzes expire on the due date.**

- In the systematic review conducted by Nils Jan Bleeker, MD, and colleagues, what was the weighted incidence of anterior knee pain after suprapatellar nailing (SP) of tibia fractures?
 - 14%
 - 29%
 - 39%
 - 46%
- What was the weighted infection rate after infrapatellar nailing (IP) of tibia fractures?
 - 9%
 - 12%
 - 18%
 - 20%
- _____ reported a significant difference between range of motion preoperatively and postoperatively at last follow-up after the SP approach.
 - One study
 - Two studies
 - Three studies
 - Four studies
- Only one study determined a statistically significant difference in _____ scores after 12 months between the SP and IP approaches.
 - Lysholm
 - Hospital for Special Surgery
 - Oxford Knee
 - International Knee Documentation Committee
- The researchers state that the definitive choice of treatment should depend on the surgeon's experience and available resources.
 - True
 - False
- Researcher Matthias Meyer, MD, and colleagues report that the rate of severe vitamin D deficiency among study patients was
 - 11%
 - 20%
 - 32%
 - 49%
- What percentage of the malnourished cohort exhibited more Clavien-Dindo Grade IV complications?
 - 2.4%
 - 5.5%
 - 7.4%
 - 13%
- Among surgical complications, the frequency of _____ was significantly higher in the cohort of patients with malnutrition compared with the cohort with normal parameters.
 - readmission
 - wound-healing disorders
 - surgical complications
 - transfusion
- The researchers found that insufficiency or deficiency of vitamin B₁₂ and folate affected neither reoperation rate nor rates of readmission, complications, and transfusion.
 - True
 - False
- Severe vitamin D deficiency led to a twofold increase in _____, with multivariable analysis identifying severe vitamin D deficiency as an independent risk factor for _____ in patients undergoing orthopaedic surgery.
 - falls
 - reoperation
 - transfusion
 - delirium

Bone and Joint in Brief

Who Is at High Risk for "Deaths of Despair?"

Nobel Prize winner Angus Deaton and economist Elizabeth Case have popularized the concept of "Deaths of Despair" among people who are socially and economically disadvantaged, suffer high levels of pain and distress, and often die prematurely from drug overdoses, suicide, and chronic liver disease. Spinal pain is common in this group.

Deaton and Case have suggested that the groups at highest risk of deaths of despair are middle-aged working-class adults with less than a college education.

A recent study by Mark Olfson, MD, and colleagues looked at the American Community Survey from 2008 through 2015 to identify other groups at risk of early mortality due to deaths of despair.

The highest-risk groups were adults with functional disabilities (102.8 per 100,000 person-years), American Indian/Alaska Native people (102.6), working-age adults who are not employed (77.3), separated or divorced people (76.5), people with net income losses (70.6), and people with military service (67.0).

"Suicide, poisoning, and chronic liver disease made roughly equal contributions to mortality during 2008–15, exacted more than twice the toll on men than women, and collectively accounted for nearly one in twenty-five deaths in this nationally representative US adult cohort," they concluded.

This is a daunting level of mortality and highlights the need to manage pain and disability, and underlying psychological and socioeconomic problems, among people from disadvantaged and socially disconnected groups. (See Olfson M et al., *Health Affairs*, 2021; 40(3):505–12.)

Editor's Note: This article was initially published in Lippincott Williams & Wilkins' The BackLetter, Volume 36, No. 6 (June 2021).

What About Horse Therapy for Chronic Back Pain?

Rarely a month goes by without *BackLetter* editors hearing about novel or overlooked treatments for low back pain (LBP). And this month is no different. A systematic review identified a treatment that has escaped the scrutiny of

this publication. It addressed the role of horseback riding—real or simulated—on chronic pain, particularly LBP.

So do studies on horseback riding support Winston Churchill's famous quote: "There is nothing better for the inside of a man than the outside of a horse?" And the answer, as with many treatments for LBP, is "maybe."

Daniel Collado-Mateo, MD, and colleagues performed a systematic review of the impact of "Equine Assisted Therapies or Horse-Riding Simulators on Chronic Pain." They found a surprising volume of evidence, including seven randomized controlled trials. And several of the studies seemed to highlight surprisingly strong treatment effects.

Ultimately the results were inconclusive. "This systematic review and meta-analysis aimed to evaluate the effects of any kind of horse-riding activity (with real horses or simulators) on pain. The main finding was that horse-riding simulators are a promising tool to reduce pain levels in people suffering from LBP. However, although the included studies were randomized controlled trials, the interpretation of results must be done with extreme caution due to the large heterogeneity, the low number of studies, and the potential risk of bias."

Most small RCTs do not provide thorough reporting on adverse effects of treatments. And one hopes that future studies—particularly of riding therapies involving live horses—will tally accidental trauma and other adverse effects. Gravity is always an issue for riders. As an old cowboy saying put it, "Never a horse couldn't be rode, never a cowboy couldn't be thrown." (See *Medicina (Kaunas)*. 2020; 56(9):444.)

Editor's Note: This article was initially published in Lippincott Williams & Wilkins' The BackLetter, Volume 36, No. 6 (June 2021).

Are Long-Term Medical Opioid Users at Heightened Risk From COVID?

There are still millions of regular medical opioid users in the United States. Some estimates put it at 8 million or more.

One of the key questions regarding this group is whether they are at heightened risk of contracting

COVID-19. And if they do come down with the virus, are they at enhanced risk of adverse outcomes—more serious infections, respiratory problems, cardiac issues, and death? And the answer to all these questions is likely "yes." Though they have not been studied adequately.

And the number of people using illicit opioids is also daunting. And COVID risks in this group may be even greater because of a variety of health issues.

A study from the Substance Abuse and Mental Health Services suggested that, in 2019, 10.1 million people 12 years and older misused opioids over the past year. (See www.samhsa.gov/data/sites/default/files/reports/rpt29393/2019NSDUHFFRPDFWHTML/2019NSDUHFFR1PDFW090120.pdf.)

Over 1 million Americans use heroin, fentanyl, and combinations of the two (www.drugabuse.gov/publications/research-reports/heroin/what-are-medical-complications-chronic-heroin-use).

One of the key issues is whether immune system compromise and diminished respiratory function would push opioid-utilizing COVID patients toward a more serious disease trajectory. And would it affect critical care management in intensive care units? (See *Journal of Opioid Management*, 2020; 16(6):401–4; doi:10.5055/jom.2020.0597.)

"Based on evidence of the immunosuppressive effects of chronic opioids, long-term users of prescription and illicit opioids comprise an unrecognized but growing population of Americans with compromised immune function and respiratory depression who may be at high risk of infection with severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and coronavirus disease 19 (COVID-19)-related hospitalization, prolonged ICU stay, adverse events, and death," noted Rahul Shah, MD, and colleagues in a recent review. "This perspective is of broad clinical and public health importance because the US has the highest population of long-term users of prescription opioids, a sequel of a decade-long practice of opioid overprescribing in the US."

Editor's Note: This article was initially published in Lippincott Williams & Wilkins' The BackLetter, Volume 36, No. 6 (June 2021).