

Perioperative management of malnutrition in the elderly[†]



Review

Yin-Bo Kang^a, Wei-Bing Shuang^{b,*}

^aDepartment of First Clinical Medical College, Shanxi Medical University, Taiyuan, Shanxi 030001, China

^bDepartment of Urology, The First Hospital of Shanxi Medical University, Taiyuan, Shanxi 030001, China

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Abstract: The nutritional situation of the elderly is closely related to the occurrence and development of many diseases. How to reduce the damage of surgery, and improve the postoperative survival rate and quality of life in malnourished elderly patients is very important. Through the elderly malnutrition perioperative risk factors analysis, we make strategies for risk factors of perioperative-related prevention, from preoperative, intraoperative, and postoperative management of patients, to improve the patient's life.

Keywords: elderly patients • malnutrition • method • perioperative management • recover

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1. Introduction

China has an aging society, wherein the nutritional situation of the elderly is closely related to the occurrence and development of a variety of diseases. The malnourished elderly often have a poor systemic condition; their organ functions decrease; and the incidence of complications such as surgery, incision, and infection is significantly increased.¹ Malnutrition refers to a state of energy or nutrient deficiency caused by insufficient intake or utilization disorders, with or without inflammation (increased metabolic demand), resulting in body composition and body cell

mass changes (especially the decrease of fat weight), which thus have adverse effects on the physical and psychological function and clinical outcomes.² The high prevalence of malnutrition in the elderly leads to or aggravates multiple negative clinical events, requiring early identification and intervention to improve prognosis. Perioperative malnutrition in the elderly is an important factor leading to complications and increase in mortality. Therefore, the problem of perioperative management of malnutrition in the elderly needs to attract our attention.

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*Corresponding author.

E-mail: shuangweibing@126.com (W.-B. Shuang).

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2. Analysis of risk factors of malnutrition in the elderly

There are many risk factors affecting malnutrition in the elderly, including internal factors such as age, organ function states, disease, and mental status, as well as external factors such as living environment, social and economic level, and lifestyle. Therefore, malnutrition in the elderly needs multidimensional and multidisciplinary evaluation and intervention.²

2.1. Internal factors

2.1.1. Taste changes

In addition to dental and oral problems, taste changes can also include food choices. The elderly have reduced saliva secretion and proneness to oral infection increase the identification threshold of a variety of taste stimuli, especially the feeling of mixed taste, which can affect appetite and increase the risk of malnutrition.

2.1.2. Changes in gastrointestinal

The gastrointestinal function of the elderly is weakened with advancement of age. If the diet is not correct, it will cause malabsorption of proteins, vitamins, and minerals. Furthermore, the elderly have a need for more protein and they are more likely to experience malnutrition than younger people when in trauma or during illnesses. Elderly patients with recovering wounds require significantly more protein at 1.5 g/kg/d, than younger patients.

2.1.3. Underlying disease

Gout affects the food choice of patients, which leads to malnutrition. The elderly with joint diseases who go to stores to buy food and prepare food are significantly affected. Gout is also a risk factor for malnutrition. The elderly mostly suffer from chronic diseases. Many old people use 2–5 drugs every day. It is easy to mutually offset between more than two different drugs or drugs and nutrients, leading to drug-induced malnutrition. For example, sympathomimetic drugs, anti-parkinsonian drugs, antidepressants, and hypoglycemic drugs can cause nausea, vomiting, taste and smell decline or dry mouth and affect the appetite. Aspirin effects on the digestive tract will hinder the normal process of food digestion and absorption. Long-term use of indomethacin and reserpine can stimulate the gastrointestinal epithelial cell walls, resulting in impaired gastrointestinal function, directly or indirectly hindering the absorption of nutrients.³

2.1.4. Psychological changes

Sudden major changes, such as the loss of a spouse or accidents, can have a huge impact on the psychology of the elderly, affecting their normal digestive function, which can lead to malnutrition. In addition, long-term lack of family care and long-term loneliness also make them unable to pay attention to their nutritional status and lead to nutritional imbalance.⁴

2.2. External factors

2.2.1. The social and economic situation

The income level also affects the habits of the elderly. Those with a high income at their disposal suffer less from malnutrition than those having a lower income. The elderly with financial constraints will inevitably try to consume less food in order to save money, and hence cause nutritional imbalance.

2.2.2. Living environment and lifestyle

Urban living, institutional pension, high education level, married, and living with partners are the protective factors of malnutrition among the elderly. The surrounding environment having pollution, including chemical pollution, noise pollution, and so on, will affect the nutritional status of the elderly.⁵

3. Perioperative management of elderly malnourished patients

3.1. Preoperative assessment of risk factors for elderly malnutrition patients

3.1.1. Preoperative nutritional and mental status assessment of the patients

Elderly surgical patients can be evaluated using the Fried Frailty syndrome criteria, Frailty index, and FRAIL scale. The Fried Frailty syndrome standard is applicable to hospitals or pension institutions, the Frailty Index assessment is applicable to professionals, while the FRAIL scale proposed by the International Society of Geriatric Nutrition is more suitable for rapid clinical evaluation. The Frail score comprises five parts: (1) fatigue; (2) resistance: difficulty on the upper staircase; (3) free movement: unable to walk one block; (4) multiple diseases coexist (>5 diseases); and (5) weight loss (weight loss >5.0% in 1 year).⁶ In addition, body mass index can be calculated by weight, height, BMI, arm circumference (AC), triceps skinfold thickness (TST), calf circumference (CC), upper arm muscle circumference

(AMC), upper arm muscle area (AMA), and upper arm fat area (AFA).⁷

Some findings suggest that preoperative assessment includes not only the physical condition and surgical risks of elderly patients, but also their mental and cognitive status.⁸ Elderly patients have cognitive dysfunction such as increased risk of postoperative delusion. Postoperative long-term cognitive impairment may be further aggravated, which will lead to prolonged hospitalization, cognitive function and physical function decline, and even increased risk of death. Before surgery, we can evaluate the patient's condition and combine it with the relevant scale in advance. The commonly used assessment scale includes the simple cognitive assessment scale (Mini-Cog).⁹

3.1.2. Preoperative evaluation of each system

Respiratory system

The respiratory system reserve of the elderly is reduced, and they are more prone to hypoxemia, hypercapnoxaemia, and acidosis during malnutrition. Pulmonary function examination is helpful to identify obstructive or restrictive lung disease and predict the risk of postoperative respiratory complications. In addition, blood gas analysis is helpful to determine the degree and type of respiratory dysfunction. Up to a certain point, the elderly may have protective reflex decline such as choking and swallowing, which are prone to reflux aspiration pneumonia.¹⁰

Circulatory system

For the elderly, the key to cardiac risk assessment is evaluation of the current cardiac function status. If there are special circumstances, cardiac ultrasound, coronary CT, coronary angiography, or myocardial nuclear examination can be done. Patients with arrhythmia or myocardial ischemia should undergo dynamic electrocardiogram examination. In patients with hypertension, elective operation should be clear, and those with a pacemaker should check that the pacing system is working properly, and also the battery lifetime.¹¹

The digestive system

The Global Malnutrition Leadership Initiative (GLIM) standard is proposed based on the European Society for Clinical Nutrition and Metabolism (ESPEN) recommendations.⁹ Loss of appetite is related to cachexia in the elderly.¹² Therefore, it is important to assess the intake of antioxidant micronutrients such as vitamin E, carotenoids,

and vitamin C.¹³ Elderly patients with chronic liver disease are on the verge of decompensation. Their anesthesia and surgical tolerance is significantly decreased and a long period of strict preparation is needed before elective surgery. When a patient with advanced liver cirrhosis and severe liver insufficiency, has coexisting severe malnutrition, emaciation, anemia hypoproteinemia, a large number of abdominal hydrocoagulation mechanism disorders, systemic bleeding, liver coma, and encephalopathy, the risk of surgery is extremely high.

The urinary system

The kidneys in the aged are on the decline with regard to the number of functional renal units, the progressive decline in renal blood flow, and the decrease in concentration/filtration function. The kidney is more sensitive to ischemia. Kidney-excluded anesthetics and their metabolites have a prolonged elimination half-life and poor tolerance to anesthesia and surgery. Preoperative assessment of surgical patients with elderly malnutrition should pay close attention to the glomerular filtration rate and bladder function status.¹⁴

3.1.3. Preoperative communication

Preoperative communication includes communication with patients and with their family members. Family members play an important role in the patient care team, with support and education, helping to improve treatment outcomes.

The preoperative communication includes past medical history and medication status; auxiliary information about cognitive and functional defects; how family members assist patients to participate in and cooperate with disease treatment; family care; and psychological counseling. Besides, during the preoperative anesthesia assessment, we can also communicate with the patient and the family members, according to the preoperative ASA anesthesia assessment level, to further understand whether the patient has organ dysfunction, whether they affect the anesthesia and surgical operation, and need special support and monitoring.¹⁵

In addition, communication to understand the patient's disease status, such as chronic diseases and inflammation, can also assess whether the patient is at risk of malnutrition. Early detection and treatment of malnutrition is crucial to improve patient outcomes.¹⁶ Therefore, understanding preoperative nutritional status through family members is important to improve surgical outcomes, reduce the occurrence of complications, and shorten the length of hospital stay.¹⁷

3.2. Intraoperative management

During the operation, the patient's vital signs are closely monitored, including blood pressure, heart rate, and breathing, to ensure the safety of the patient. Ignoring some of the underlying diseases and conditions in the most typical cases of the elderly may have an impact on the intraoperative and postoperative time.

The anesthetic method should be selected considering the past medical history, surgical method, and surgical duration. Anesthetic drugs have extensive physiological effects, but the interaction of anesthetic drugs should be fully considered. Intraoperative complications such as bradycardia, other conduction disturbances, hypotension, hypertension, arrhythmia, and clinical death were recorded. Body temperature is maintained during surgery. Intraoperative hypothermia means that the body temperature is $<36.0^{\circ}\text{C}$, with corresponding risks of hypothermia, including infection, cardiac emergencies, coagulation dysfunction, and increased oxygen consumption. Therefore, it is necessary for medical staff to monitor in real time, timely detection, timely treatment, and give a hot air environment and drip warm liquid.

Attention should be paid during invasive operation, so as to maintain the hydraulic electrolyte balance of patients to prevent dehydration and electrolyte imbalance caused by the operation. Blood sugar and urine volume should be monitored at all times. For elderly patients with diabetes, attention should be paid to monitoring blood sugar and urine volume to control blood sugar levels and prevent complications caused by blood sugar fluctuations.¹⁸

3.3. Postoperative management

3.3.1. Postoperative nutritional support

According to their nutritional status and surgery, appropriate nutritional support, including enteral nutrition (EN) and parenteral nutrition should be taken care of. Of all the factors that affect postoperative morbidity and mortality, nutritional status is the most important.¹⁹ Malnutrition significantly increases the morbidity and mortality of postoperative complications, leading to prolonged hospital stay and altered quality of life.²⁰ According to the evaluation results, appropriate nutritional support was provided to patients with nutritional risk, such as EN and parenteral nutrition.²¹

As part of the joint management of multidisciplinary intervention, caregivers should work together to provide personalized nutrition information, education, and nutritional counseling services to the malnourished or at risk, to raise awareness of nutritional problems and promote adequate dietary intake.² After finding elderly patients

with malnutrition risk by using nutrition screening tools, the diagnosis and grading of malnutrition should be clarified according to the GLIM criteria. For example, esophagectomy is one of the most invasive procedures for patients with esophageal cancer; besides tumor resection, the procedure requires extensive surgical fields and lymph node dissection and resection. Because the function of the esophagus affects the metabolism, and the neuroendocrine and immune systems, the postoperative nutritional status will be significantly worsened due to high metabolism and digestive and absorption disorders.²² Furthermore, the oral food intake was significantly reduced after surgery due to mechanical and functional changes in the gastrointestinal tract leading to swallowing disorders, and early saturated postprandial dumping syndrome.²³ Therefore, some patients with esophageal cancer need EN and parenteral nutrition to meet the perioperative nutritional needs.

Different surgical sections use different ways of nutrition intake post-operation. For non-abdominal surgery, such as subarachnoid anesthesia and epidural anesthesia, EN support can be provided for 3–6 h after surgery. In general anesthesia, after nausea and vomiting has disappeared, EN can be performed. Gastrointestinal surgery generally needs fasting for 24–48 h; after the recovery of intestinal peristalsis, EN support can be gradually increased. If adequate energy cannot be obtained by EN, supplementary parenteral nutrition (SPN) support should be given to meet the demand, to improve the nutritional status and clinical outcomes.²⁴

Depending on the patient, it is expected that without oral intake for >3 d or dietary intake $<50\%$ of energy needs for up to 1 week, EN should be provided to meet nutritional needs and maintain or improve nutritional status. If the expected EN time is <4 weeks, use the nasal feeding tube; if the expected EN time is 4 weeks or intolerant, select percutaneous endoscopic gastrostomy (PEG) or percutaneous endoscopic jejunostomy (PEJ), and the first 3 d of EN treatment should be closely monitored to prevent complications. According to the situation of the individual, when there is a severe disorder of gastrointestinal function, and EN cannot be used or EN cannot meet 60% of the target requirements, PN should be initiated to meet the individualized needs. It should be closely monitored during treatment to avoid complications. According to the results of comprehensive nutrition assessment, individualized calorie target value, protein target value, trace element target value, and fluid target value are formulated for patients. It is recommended that the elderly with malnutrition or nutritional risk have dietary reinforcement between meals and attention should be paid to providing improved

fortified food for those with difficulties in swallowing and chewing, to ensure adequate energy intake.

Some postoperative elderly patients can also take oral nutrition agents. The benefits of oral nutrition are explained by the cephalic thermogenic response (CPR). CPR is to prepare food digestion and absorption for the gastrointestinal tract by promoting physiological changes before food intake.²⁵ CPR stimulates the vagus nerve, resulting in the release of bioactive substances (saliva, gastric fluid, and exocrine pancreatic fluid) and hormones (insulin and glucagon). Furthermore, CPR leads to increased gastric motility, changes in heart function, increased blood pressure, increased respiratory entropy, and increased postprandial thermogenesis metabolic rate. A randomized controlled trial and an animal experiment with colorectal surgery showed that oral and sham feeding (using chewing gum) enhanced the autonomic nervous system and reduced inflammatory complications and hospital stay more than the enteral and parenteral pathways.²⁶ Furthermore, oral feeding reduces complications and hospital stay more than the enteral route in upper gastrointestinal surgery.²⁷

3.3.2. Postoperative analgesia

The elderly have difficulty in pain assessment due to disease, decreased metabolism, and cognitive dysfunction, which increases the difficulty of postoperative analgesia. Poor postoperative analgesia can induce or aggravate postoperative delusion, and excessive analgesia may also lead to cognitive dysfunction, delusion, and so on. Providing individualized patient and family centered education should be included in the entire surgical procedure, rehabilitation program, extent and pattern of postoperative pain, pain management methods, and pain management objectives.

Elderly patients with malnutrition need to develop an individualized and multimodal analgesic regimen according to their past medical history and drug use.²⁸ Acetaminophen and non-steroidal anti-inflammatory analgesics can be used as the first-line pain treatment for multimodal analgesia in the elderly; intravenous-controlled analgesia (patient controlled analgesia [PCA]) enables dynamic management and improves the analgesic effect; local infiltration analgesia (LIA) during the incision is for injection or infiltration of a long-acting local anesthetic. Less systemic response means good local analgesic effect. Surgical site-specific peripheral nerve block techniques can be used for analgesia after geriatric orthopedic surgery. Low risk and definite analgesic efficacy, less systemic impact, and Rhomboid abdominis plane (transversus abdominis plane [TAP]) block is a method of regional block. Perioperative analgesia for

abdominal surgery in the elderly is done by conduction of blocked spinal nerves.²⁹

3.3.3 Postoperative activity guidance

Elderly malnourished patients are encouraged to perform appropriate postoperative activities to promote patient appetite and recovery of blood circulation.

According to the condition of the patient's body and surgery, appropriate activity guidance, including exercise type, intensity, and frequency are given. In clinical practice, based on the comprehensive assessment of nutrition, the multidisciplinary team should develop individualized multicomponent exercise programs and rehabilitation exercise programs to maintain or improve muscle quality and function for the undernourished or at risk of undernutrition, while ensuring adequate caloric and protein intake.²

Researchers have explored numerous activity interventions in elderly patients, such as diet and nutrition guidance interventions, psychosocial support, cognitive training, physical training, and physical therapy programs. Exercise interventions in the elderly, such as resistance training, individual progressive dual-task training, multicomponent exercise, and traditional Chinese medicine exercise (Baduanjin, Taijiquan), have also been explored. However, there is great heterogeneity among the different studies in terms of the timing, frequency, outcome measures, and effect evaluation of the exercise intervention. This study found that moderate-to-high-intensity exercise reduced fatigue and depression symptoms in elderly patients. These improvements were accompanied by metabolic changes. Moderate to high intensity exercise should be implemented in the standard care.³⁰ In addition, to maintain beneficial effects, one needs to maintain exercise. Aerobic and resistance exercise improve physical fitness in aerobic capacity, endurance, and strength in elderly patients.³¹ Patients are followed up during their postoperative exercise to understand their recovery and give necessary guidance. In the future of patient recovery, legal care services may decrease, rather than increase, suggesting that the burden of care will again fall on the spouse (possibly elderly), other family members, or the private sector (nursing home). This, coupled with the findings that many elderly people with severe mental and physical disabilities can live for a long time, fully demonstrates the importance of providing public and voluntary services.³²

4. Conclusions

Perioperative management of malnutrition in the elderly is very important, and should be carried out from many

aspects and disciplines. According to the risk factors of malnutrition in the elderly, including diet, exercise, and other aspects crucial for the survival rate and quality of life of patients. Paying attention to the relevant precautions of malnutrition, and doing a good job of perioperative, preoperative, intraoperative, and postoperative management can improve patients' medical experience and happiness index. Comprehensive postoperative management of nutrition management in the elderly should adopt a multidisciplinary decision-making model of "screening-multiple intervention-joint management", with regular follow-up and adequate dietary intake to improve functional and clinical outcomes.² Emphasis is paid to postoperative pain management and through it for patients to relieve the pain

of patients and promote recovery.³³ To prevent complications, measures should be taken to prevent the occurrence of complications, such as infection and deep venous thrombosis. Necessary psychological counseling and support for elderly patients to help them relieve tension and anxiety and promote recovery are other steps that need to be taken of.

Ethical approval

Ethical issues are not involved in this paper.

Conflicts of interest

All contributing authors declare no conflicts of interest.

References

- Zheng ML, Chen W, Li TT, et al. Status and evaluation criteria and prevention and control measures of malnutrition among the elderly. *Chin J Clin Health Care*. 2023;26:452–455 (in Chinese).
- Ma LN, Ji T, Li HL, et al. Chinese expert consensus on the multidisciplinary decision-making model of malnutrition among the Elderly (2023). *Chin J Clin Health Care*. 2023;26:433–445 (in Chinese).
- Grong LJ. Malnutrition and nursing intervention in the elderly. *Chin Med Guide*. 2013;11:365–366 (in Chinese).
- Liu AY, Zhang JQ. Analysis of the causes of the elderly malnutrition and nutrition assessment. *Gen Care*. 2009;7:1821–1833 (in Chinese).
- Qu ZXA. Study on the related factors of malnutrition among the elderly and the intervention methods. *E-Journal Pract Clin Nurs*. 2019;4:86–98 (in Chinese).
- Chong E, Huang Y, Chan M, Tan HN, Lim WS. Concurrent and predictive validity of FRAIL-NH in hospitalized older persons: an exploratory study. *J Am Med Dir Assoc*. 2021;22:1664–1669.e4.
- Leandro-Merhi VA, de Aquino JL. Determinants of malnutrition and post-operative complications in hospitalized surgical patients. *J Health Popul Nutr*. 2014;32:400–410.
- Thorsdottir I, Jonsson PV, Asgeirsdottir AE, Hjaltdottir I, Bjornsson S, Ramel A. Fast and simple screening for nutritional status in hospitalized, elderly people. *J Hum Nutr Diet*. 2005;18:53–60.
- Borson S, Scanlan J, Brush M, Vitaliano P, Dokmak A. The mini-cog: a cognitive 'vital signs' measure for dementia screening in multi-lingual elderly. *Int J Geriatr Psychiatry*. 2000;15:1021–1027.
- Skloot GS. The effects of aging on lung structure and function. *Clin Geriatr Med*. 2017;33:447–457.
- Sündermann S, Dademasch A, Praetorius J, et al. Comprehensive assessment of frailty for elderly high-risk patients undergoing cardiac surgery. *Eur J Cardiothorac Surg*. 2011;39:33–37.
- Suzuki H, Asakawa A, Li JB, et al. Zinc as an appetite stimulator – The possible role of zinc in the progression of diseases such as cachexia and sarcopenia. *Recent Pat Food Nutr Agric*. 2011;3:226–231.
- Bartali B, Frongillo EA, Guralnik JM, et al. Serum micronutrient concentrations and decline in physical function among older persons. *JAMA*. 2008;299:308–315.
- Huang Y, Wang B, Hassounah F, et al. The impact of senescence on muscle wasting in chronic kidney disease. *J Cachexia Sarcopenia Muscle*. 2023;14:126–141.
- Fitz-Henry J. The ASA classification and peri-operative risk. *Ann R Coll Surg Engl*. 2011;93:185–187.
- Ścisło L, Bodys-Cupak I, Walewska E, Kózka M. Nutritional status indicators as predictors of post-operative complications in the elderly with gastrointestinal cancer. *Int J Environ Res Public Health*. 2022;19:13453.
- Obermair A, Simunovic M, Isenring L, Janda M. Nutrition interventions in patients with gynecological cancers requiring surgery. *Gynecol Oncol*. 2017;145:192–199.
- Chataule SM, Hazarika A, Jain K, et al. Preoperative forced-air warming strategy: is it effective in averting intraoperative hypothermia in elderly trauma surgical patients? *Cureus*. 2022;14:e29305.
- Malavolta M, Giacconi R, Piacenza F, et al. Plasma copper/zinc ratio: an inflammatory/nutritional biomarker as predictor of all-cause mortality in elderly population. *Biogerontology*. 2010;11:309–319.

20. Isaksen B, Fagerhol MK. Calprotectin inhibits matrix metalloproteinases by sequestration of zinc. *Mol Pathol*. 2001;54:289–292.
21. Ribeiro SM, Moya AM, Braga CB, et al. Copper-zinc ratio and nutritional status in colorectal cancer patients during the perioperative period. *Acta Cir Bras*. 2016;31(suppl 1):24–28.
22. van Niekerk G, Davis T, Engelbrecht AM. Hyperglycaemia in critically ill patients: the immune system's sweet tooth. *Crit Care*. 2017;21:202.
23. Kight CE. Nutrition considerations in esophagectomy patients. *Nutr Clin Pract*. 2008;23:521–528.
24. Okada G, Momoki C, Habu D, et al. Effect of postoperative oral intake on prognosis for esophageal cancer. *Nutrients*. 2019;11:1338.
25. LeBlanc J. Nutritional implications of cephalic phase thermogenic responses. *Appetite*. 2000;34:214–216.
26. van den Heijkant TC, Costes LM, van der Lee DG, et al. Randomized clinical trial of the effect of gum chewing on postoperative ileus and inflammation in colorectal surgery. *Br J Surg*. 2015;102:202–211.
27. Lassen K, Kjaeve J, Fetveit T, et al. Allowing normal food at will after major upper gastrointestinal surgery does not increase morbidity: a randomized multicenter trial. *Ann Surg*. 2008;247:721–729.
28. Beverly A, Kaye AD, Ljungqvist O, Urman RD. Essential elements of multimodal analgesia in enhanced recovery after surgery (ERAS) guidelines. *Anesthesiol Clin*. 2017;35:e115–e143.
29. Liu SS, Wu CL. Effect of postoperative analgesia on major postoperative complications: a systematic update of the evidence. *Anesth Analg*. 2007;104:689–702.
30. Kucharski D, Lange E, Ross AB, et al. Moderate-to-high intensity exercise with person-centered guidance influences fatigue in older adults with rheumatoid arthritis. *Rheumatol Int*. 2019;39:1585–1594.
31. Lange E, Kucharski D, Svedlund S, et al. Effects of aerobic and resistance exercise in older adults with rheumatoid arthritis: a randomized controlled trial. *Arthritis Care Res (Hoboken)*. 2019;71:61–70.
32. Jagger C, Clarke M, Cook AJ. Mental and physical health of elderly people: five-year follow-up of a total population. *Age Ageing*. 1989;18:77–82.
33. Woodburn SE. Postoperative pain management. *Clin Podiatr Med Surg*. 1994;11:55–64.