Title: Medication consideration prior to surgery: a brief review

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Abstract

The use of various medications by patients undergoing elective surgery is quite prevalent with advancing age. Gathering information and documentation of drug history is essential for safe surgical practice. However, there is a scarcity of available literature focusing on this important subject. Detailed knowledge about patient's medication history: including current and discontinued pharmaceuticals: their interaction with surgical prophylaxis, and impact on procedure outcome, is imperative. The present review looked into the medication consideration preoperatively and its impact on surgical outcome. Scientific articles involved in this review were obtained from scientific websites. We used different combinations of keywords to obtain all possible articles related to the current subject based on inclusion criteria. The included articles in the current review were published between 2007 and 2021. The review found Medication consideration before the surgery to involve drug history taking, medical management of the patient, and surgical prophylaxis. Comprehensive pharmaceutical contemplation is essential before surgery for the patients ‘safety and to avert adverse events.

Keywords: Consideration, medication, preoperative, surgery.
1. Introduction:

During an office-based preoperative evaluation of patients: medical history, latest treatment, presenting conditions, and any risk factors that may affect or raise the incidence of the surgical complications are analysed thoroughly [1]. The optimization of a patient’s medical status is usually attained in the outpatient visit prior to any surgical intervention to achieve an accurate preoperative risk assessment. [1]. A common problem related to the safety of patients globally is the lack of complete and accurate details about the home medications of patients [2]. It is an everyday routine to encounter patients taking various medications, with difficulty recalling the reason behind their administration or why they were prescribed [1]. Comprehensive knowledge of preoperative medication is essential for patients’ safety; however, a few randomized controlled trials with limited evidence discuss the importance of medication history. The Existing data mainly rely on in vitro experiments, case reports, expert consensus methods, and specific other related statistics [3]. Moreover, there is a marked deficiency in the scientific literature on medication consideration before surgery; this study has been conducted to review pre-operative drug usage trends, including medication history and pharmaceutical prophylaxis.

2. Literature Search

This scientific review is based on articles retrieved from Google Scholar, Research Gate, and Pubmed. The search was conducted using several combinations of keywords to obtain articles related to the current subject, including "Medication consideration and surgical patients, Medication history and surgery, Medication management, and Prophylaxis before surgery." The main title of each article was reviewed, and then non-full text articles, irrelevant publications, and duplicated literature were excluded. The abstract and the detail of each included article published between 2007 to 2021 were thoroughly reviewed. The discussion has been divided into three main sub-titles, enlightening various aspects of medication consideration before surgery.

3. Discussion:

3.1 Medication history:

Medication information is traditionally recorded in the medication history section of the physician's notes. The errors in the drug history can lead to unwanted effects in therapy, inappropriate management, failure to determine drug-related problems, and undue cessation of medications [4]. It is obligatory to take the medication history preoperatively, including the exact name, frequency, and dosage. Over-the-counter medication used, supplements,
vitamins, and prescription-strength should be investigated and recorded for each patient before surgery [3]. This information should be collected at least one week before an elective surgery [5].

The medication history should not be limited to current medications taken by the patients, but it should involve the medications that have been stopped or changed recently [6]. Precise recording and effectual transfer of drugs-related information to hospital prescribers can be a significant challenge [7].

Patients may not remember all their medications administrated. So, it is imperative to obtain a detailed description of each drug, such as its form; liquid, tablet, topical formulation, or capsule, shape, size, colour, and any letters, words, and dosage numbers if the patient can recall. If the patient is unable to reproduce some home medication-related information, primary physicians or the pharmacists involved may be capable of identifying the drug by specific details, including the dose and other related information provided by the patients [4]. The pharmacist is responsible for clarifying home medication regimens as surgeons are not usually the original prescribers for home medications [7]. It was found that pharmacist involvement in elective procedures admission clinics reduced medication discrepancies resulting from incomplete medication history [7,8,9,10]. Improvement in safety standards related to patients management and knowledge of home medications is achievable prior to scheduled surgery by multidisciplinary teamwork involving anesthesiologists and pharmacists [11].

In addition, Orthopedic surgery patients’ medication charts completion rate has been reported around 94%, and only 30% of 143 admissions under Urology and General Surgery departments. The comprehensive information was recorded in the charts involving all patients’ medications, venous thromboembolic risk assessment, prescribed thromboprophylaxis, i.e. low molecular weight heparin, in an appropriate manner if indicated. [12] Detailed history-taking of surgical patients can be undertaken via telephone instead of the face-to-face interview; however, this alternative strategy has been recommended and effective among low-risk elective surgical patients [13].

Inappropriate medications among geriatric patients can elevate the risk of poor surgical outcomes and adverse events. In a Chinese study conducted on the geriatric population, it was found that high-risk preoperative medications were more common among patients 70 years and older [14], which may lead to an above-average postoperative complications rate.

3.2 Medication’s history and impact on surgery:

Specific criteria have been established to determine whether the medication has to be continued or stopped peri-operatively [3], especially if the withdrawal of the drug causes a potential health issue [1]. The risk of drug-related adverse effects may arise due to the inappropriate withholding or withdrawal of medications that had been in use for the long term by the patient in the preoperative phase [15,16]. In general, drugs that maintain homeostasis should be continued. An exception is medications that may increase the chances of side effects, including non-steroidal anti-inflammatory drugs.[5]. Drugs that cause rebound syndrome or withdrawal generally continue during the perioperative period if stopped
suddenly. Clonidine, statins, corticosteroids, beta-blockers, and selective serotonin reuptake inhibitors (SSRIs) are common medications that cause withdrawal symptoms [3]. All medications that do not contribute to maintaining homeostasis must be interrupted, such as natural products, non-prescribed drugs, and nutritional supplements [5].

**3.3 Impact on Respiratory system:**

Inhaled beta-agonists, Steroids, and anticholinergics inhaled medications were recommended to be continued perioperatively. In contrast, certain medications have to be stopped, such as theophylline, due to serious side effects, namely, neurotoxicity and arrhythmias.[17].

On the other hand, smoking cessation should be warranted six to eight weeks before the operation to reduce pulmonary complications postoperatively. It was found that the immune system recovery takes four to six weeks before surgery; this, in turn, reduces the chance of postoperative infection. Moreover, Smoking cessation at least 12 to 72 hours before surgery has shown significant benefits in reducing the incidence of developing hypoxia as the carbon monoxide and nicotine half-life is 12 hours [18].

**3.4 Impact on the Endocrine system**

This includes common hormonal medications: insulin, contraceptive and hormone replacement therapy, and diabetes mellitus. Regarding diabetic patients, it is necessary to maintain fluid and electrolyte balance, avoid marked hyper/hypoglycemia and prevent ketoacidosis. The glucose level should be maintained at less than 140mg/dl for fasting glucose and less than 180mg/dl for random glucose, with haemoglobin A1C less than 7% [19,20].

In case of oral hypoglycaemic medications (type 2 diabetes), the recommendation is to hold morning dose on the day of surgery; however, metformin should be held for two days prior to surgery because it leads to lactic acidosis, metformin can be resumed within 2 to 3 days after surgery provided the renal function is optimal. [21].

Patients on a regular dose of injection Insulin of either type 1 or 2 diabetes should follow the endocrinologist recommendations for their treatment, including taking half of the long-acting insulin regimen in the morning while holding their short-acting insulin dose. [22].

Additionally, hormonal replacement therapy and contraceptive should be discontinued one month before the operation, if possible, as it increases the risk of venous thromboembolism with lower extremity fractures by 18 folds. However, the study sample size was too small to produce definitive conclusions. Deep venous thrombo-prophylaxis is warranted in case of recommended use of these medications’ peri-operatively [23].

**3.5 Impact on Central nervous system:**

Medications of seizures such as carbamazepine, valproic, and phenytoin should be continued in the preoperative period [24]. Antiparkisonian medications, if ceased without tapering, cause an abrupt withdrawal; this withdrawal could cause neuroleptic malignant syndrome or
Parkinson's flares [22]. Furthermore, patients with psychological illnesses such as depression and administering SSRIs have no obvious interaction with anaesthetics agents, but discontinuation of these drugs lead to many withdrawal symptoms. [1].

Moreover, benzodiazepines, if discontinued suddenly, can cause unusual withdrawal symptoms; it is recommended to be continued preoperatively [1]. Lithium administrated by bipolar patients can be continued in minor surgeries, provided the serum level is not toxic with stable electrolytes and normal renal function. Lithium should be ceased 2-3 days before operation if the forementioned problems exist, and it can be resumed for usage postoperatively once electrolytes and the renal function returns to normal [24].

3.6 Impact on Blood components:

Non-steroidal anti-inflammatory medications (NSAIDs) produce a reversible suppression of cyclo-oxygenase (COX), which causes a drop in thromboxane A2 synthesis, decreasing platelet aggregation. So, the inhibition of COX increases the probability of platelet aggregation; however, the function of platelets returns to normal within three days of discontinuation of these medications. For this reason, NSAIDs are generally recommended to be discontinued three to five days before surgery. On the other hand, indomethacin and ibuprofen can be stopped one day before surgery as both are known to have a very short half-life. [24].

Aspirin also inhibits COX, but irreversibly; perioperatively, Those Cases with a moderate or high risk of developing cardiovascular events, Aspirin has been suggested to be resumed as per the 2012 Chest guidelines. High-risk patients include a history of myocardial infarction, unstable angina, a history of cerebrovascular disease, or coronary stenting. Discontinuation of aspirin should be seven to ten days before surgery in low-risk patients to allow for reversal of the anticoagulant impact. Aspirin can be resumed postoperatively after 24 hours when adequate hemostasis is achieved [25].

Patients diagnosed with atrial fibrillation are usually managed by warfarin; a cardiologist should be involved in the patient management to make recommendations and decide whether to continue the medication or vice versa. Low-risk individuals can safely discontinue the medication without bridging therapy or using low molecular weight heparin. Bridging therapy may be required in individuals at higher risk, such as those with a previous embolization history. Medication such as LMWH within 12 hours prior to any surgical intervention should be avoided. However, in the case of spinal anaesthesia, it has to be discontinued at least one day prior to operation. Furthermore, renal insufficiency patients can experience prolonged LMWH clearance, so proper laboratory monitoring is essential [26].

3.7 Impact on blood pressure:

For elective procedures, adequate blood pressure control and monitoring are necessary to limit the risk of myocardial ischemia. Patients with hypertensive disorders or cardiac abnormalities may require specific medication during the preoperative assessment. It is recommended to continue calcium channel blockers, statin drugs, digoxin, beta-blockers, and alpha-2-agonists. Few classes of cardiovascular medications are better to be avoided on the
morning of the procedure, such as angiotensin-converting enzyme (ACEi) inhibitors, non-statin (bile sequestrants and niacin), diuretics, and angiotensin receptor blockers (ARBs). [24].

Rebound hypertension can develop as a result of stopping Alpha-2-agonists such as clonidine. Beta-blockers decrease the risk of myocardial infarction when taken preoperatively by reducing the demand for myocardial oxygen and assisting in preventing arrhythmias by lessening the postoperative sympathetic drive [22]. Patients who have been using beta-blockers for a long time must not stop taking them during preoperative. Additionally, individuals with a higher chance of developing cardiac complications include patients with intermediate cardiac risk undergoing a surgical procedure or patients at higher cardiac risk like those with coronary heart diseases and who underwent vascular surgery should be started on beta-blockers 1-2 weeks before operation with proper dose adjustment to maintain the heart rate within a specific range of 60 to 100 beats per minute [5].

Calcium channel blockers reduce arterial arrhythmias and ischemia. Digoxin helps control atrial fibrillation and supraventricular tachycardia preoperatively [24]. Statin improves endothelial function and reduces vascular inflammation [1]. Statins should be considered for intermediate-risk patients or those planned for vascular surgery. In general, patients who take statins regularly should continue using them during the preoperative period. [5]. Non-statins such as Niacin are usually stopped a day before surgery as they can cause rhabdomyolysis and myopathy preoperatively. Moreover, it can progress to a condition called bile sequestrants which could interfere with bowel function especially absorption. [27].

Angiotensin receptor blockers and ACE inhibitors strengthen the impact of anaesthesia induction if given less than ten hours before the operation. Also, it was found that the incidence of preoperative hypotension has increased in those patients who continued ACE inhibitors and ARBs compared to those who withheld, with no variation in the rate of preoperative myocardial ischemia [28]. Diuretics should be avoided on the morning of the day of the procedure, as they can potentially cause hypokalaemia and can result in adverse effects when interacting with anaesthetic agents which ultimately results in volume depletion. [27].

4. Medication prophylaxis prior to surgery:

4.1 Preoperative steroids:

Steroid stress dosage administration is warranted preoperatively in patients who have been using prednisone for a long time with at least 3 weeks duration. Anaesthesiologists give a dosage of 25-100 mg of hydrocortisone at induction of anaesthesia and an additional dose of 100 mg at discharge. Under non-stressful conditions, normally, cortisol is produced by the adrenal gland nearly 25-30 mg per day. In contrast to stressful situations, a higher amount of cortisol, up to 200-500 mg, is synthesized daily. [24].

4.2 Antibiotics:
Surgical site infection (SSI) is commonly known as an infection that arises primarily around or in the surgical wound area. The duration of the SSI incidence can vary in duration between weeks, months, or up to a year if certain implants are left in place following surgery. [29,30]. In surgical patients, it was found that SSI was the major cause of nosocomial infection, accounting for almost forty per cent [30]. These infections affect the patients adversely and reduce the patients' quality of life. [31]

The Centres for Disease Control and Prevention (CDC) shows that nearly 500,000 surgical site infections develop each year in the United States [32]. Antibiotic prophylaxis coverage has to be administered throughout the surgical procedure to ensure the drug's optimum tissue and serum level. In clean-contaminated surgeries: antibiotic prophylaxis should be given, and in certain clean wounds where surgical site infection could be fatal to the patient, such as prosthetic joint placement. [34,35]. Dirty and contaminated wounds such as repairing the perforated colon generally do not require antibiotic prophylaxis as the patients will already receive specific antibiotic treatment for the established infection. [33].

The Centres generated the surgical care improvement initiative for Medicare and Medicaid Services (CMS), the CDC, and 10 other national organizations (SCIP). [36]. This project involved measures integrated into the SCIP widely expanded [34-36]. The measures of SCIP aim to reduce the postoperative SSIs, these measures including [37]: a) Initiation of antibiotics within 60 minutes prior to incising the skin or if the patient is receiving fluoroquinolones or vancomycin should be within 120 minutes; b) Antibiotics given to the patients as prophylactic therapy should be suitable for the patient's operation; c) Generally, antibiotics used as a prophylactic treatment must be stopped following the surgery completion, but certain operations such as cardiothoracic may need to continue for 48 hours.

According to a survey of US hospitals, these measures are not consistently implemented. Approximately 55.7% of individuals who underwent surgery received prophylactic antibiotic treatment within 1 hour after the skin incision, and the antibiotic was discontinued 24 hours following surgery by only 40.7 per cent of individuals [38]. One study reported a high rate of prophylactic antibiotics administration among surgical patients (80-90%); however, in 25-50 per cent of patients, the regimen followed, duration of prophylaxis, and timing of treatment was considered inappropriate. [39].

The data analysis of 2847 surgical cases undergoing clean surgical procedures or contaminated found that the frequency of SSIs was 0.6% in patients under a prophylactic antibiotic regimen within two hours before the incision. In contrast, the SSIs increased by two folds when the antibiotic was given more than three hours after surgical incision. The rate increased to six-folds among patients who took antibiotics more than 120 minutes before incision [40]. A multi-centre study of 29 hospitals in the US demonstrated that antibiotic administration within half an hour before incision might reduce the risk even further compared to one hour [41].

The type of antibiotic also significantly impacts the efficacy; before the incision is made, the infusion of vancomycin or fluoroquinolones should be initiated within 60-120 minutes to
count a longer infusion time. Moreover, the prophylactic antibiotic infusion should be given before inflating the tourniquet [34,35].

The antibiotic of choice should be appropriate to the surgery and selected according to the local antibiogram. The antibiotic should be active against most likely infectious agents but not eradicate all potential organisms [33]. The cessation of antibiotics is recommended within 24 hours after the surgery [34]. Moreover, there were no benefits documented for antibiotics after wound closure in reducing the SSIs [42-44].

5. Conclusion:

Medication consideration before the surgery involves three aspects medication history, documenting relevant management before surgery, and drug prophylaxis. Medication history is necessary to be taken, and it involves not only the current medication but the previous discontinued medication administrated. Accurate medication history taking reduces the possibility of medication errors and complications that may be caused during or after surgery. Pharmaceutical management involves the determination of the indication to continue or withhold it preoperatively. Some medications must be ceased before surgery, and others must be continued; this decision is dependent on the role of the drug, its impact on surgery, the status, and the need of the patient. Prophylaxis mainly involves antibiotics to prevent surgical site infection; however, giving prophylactic antibiotics should be based upon a recommended regimen. Additionally, the duration, type and timing of prophylactic antibiotics should be appropriate to each specific surgical procedure.

The reported inadequacies are related to preoperative medication consideration include inaccurate drug history, management, and improper prophylaxis adherence. Therefore, further studies should be undertaken to address these deficiencies in detail, and intense efforts should be made to ensure perfection in all the above-mentioned domains to ensure patient safety.

List of Abbreviations:
ACE Angiotensin-converting enzyme
CDC Centres for disease control and prevention
CMS Medicaid services
COX Cyclo-oxygenase
NSAIDs Non-steroidal anti-inflammatory medications

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