

“Too much information with little meaning,” relevance of preoperative laboratory testing in elective oral and maxillofacial surgeries: A systematic integrative review

ABSTRACT

Aim: In the recent times due to accessibility of tools and advent of technology advising battery of laboratory tests prior to any elective surgical procedure has become a norm. This review aims at investigating relevance of such tests in healthy patients undergoing routine elective oral and maxillofacial surgical procedures.

Methods: Various search engines were thoroughly searched to identify relevant literature. The population of interest was asymptomatic adults above 18 years of age undergoing elective surgery.

Results: The preoperative tests of interest for the current study included complete blood count, coagulation tests, biochemistry, and chest X-rays. An algorithm for preoperative tests has been proposed.

Conclusion: We conclude that advising battery of routine tests in such patients leads to further delays and rise in overall cost of the surgery.

Keywords: Dentoalveolar, elective surgeries, guidelines for preoperative evaluations, maxillofacial surgeries, preanesthetic preparations, preoperative laboratory investigations

INTRODUCTION

Preoperative laboratory investigations are an important part of any surgical checklist. Surgeons, all over, recognize the significance of this step in optimizing their patients before the surgeries. Preanesthetic assessment of patients involves a thorough investigation through the history and clinical assessment along with physical examination.^[1-6] Laboratory investigations supplement this judgment. Advice of routine blood investigations for elective surgical procedures in clinically healthy patients is based on long-term perception that such tests aid in the detection of abnormal findings that are clinically concealed, which place patients at risk during surgery and delay postsurgical recovery, if left undetected. There is a lack of uniformity in the practice of advising preoperative tests. This could be due to poor awareness and implementation of guidelines world over.

A plenty of scientific literature concerning this subject is found in general surgery, yet such is not the case for Oral

and Maxillofacial Surgery (OMFs). The conclusions are drawn for elective OMF surgeries from the general surgical guidelines on preoperative evaluation.^[7,8] Therefore, the main objectives of this review are to compile and appraise the available literature to understand the current perspective of the surgeons and anesthetists in preparing their patients for

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the elective OMF surgeries and suggest an algorithm for the selection of relevant preoperative laboratory tests.

METHODS

Literature search

Different search engines were used to compile the studies relevant to the topic under review. The databases MEDLINE, PubMed, ScienceDirect, Cochrane Database of Systematic Reviews, Wiley Online Library, and Google Scholar were thoroughly searched relevant systematic reviews, narrative reviews, guidelines, recommendations, studies, and abstracts. The keywords utilized for search were presurgical, preoperative laboratory investigations, preoperative test, evaluation, guidelines, preanesthetic preparations, elective surgeries, maxillofacial surgeries, and ASA categories. At first, search the keywords and their combinations were used, and then, the process was continued by selecting manually other relevant citations from the initial search. This process continued till sufficient literature was collected. Since this is a review without any participation of human or animal models, no ethical committee approval was required.

All the studies evaluating the current topic of investigation, irrespective of type of surgical specialization, were included. The criteria for exclusion were studies published before 1985, studies that did not report primary outcome data relevant to the current review, and studies that included investigations in co-morbidities. The entire search process was restricted to publications in English language. The literature that was included in the current review was recent reviews, guidelines, recommendations, and prospective and retrospective studies published in the time frame mentioned above. The population of interest was asymptomatic adults above 18 years of age undergoing elective surgery. The preoperative studies that were of interest for the current study included chiefly laboratory tests (complete blood count, coagulation tests, and biochemistry) and chest X-rays. Electrocardiogram (ECG) and echo were discussed briefly. Studies on pediatric patients were excluded.

RESULTS

One hundred and fifty research papers were found in the first search. Scientific literature relevant to the study was identified and segregated into following categories:

- i. Guidelines: 4
- ii. Reviews on preoperative tests in general elective surgery: 8
- iii. Reviews on preoperative tests in OMF elective surgery: 2
- iv. Prospective/retrospective studies on preoperative tests in general elective surgery: 34

- v. Prospective/retrospective studies on preoperative tests in OMF elective surgery: 3

Total number of papers included: 51.

DISCUSSION

Preoperative laboratory investigations represent a special class of screening tests. The main purpose of these tests as mentioned earlier is to provide additional diagnostic and prognostic information to supplement the clinical history and assessment of a patient with the following aims:

- Evaluating the appropriateness of the ongoing course of clinical assessment and management
- Comprehensive risk evaluation of the patient due to general anesthesia
- Possibility of delay or cancellation of surgery due to unavailability of test results
- Establishing a baseline measurement for later reference
- Predicting intraoperative and postoperative complications
- Predicting risk due to unknown undiagnosed medically relevant conditions and medicolegal considerations.^[9]

Till the mid-nineties, clinicians evaluated patients preoperatively. Based on thorough history and physical examination, only selective laboratory tests were ordered to support or negate the clinical findings.^[10-12] However, with change in times and better patient awareness of their rights along with advent of automation in clinical laboratories, injudicious ordering of scores of tests has gained support among physicians and surgeons.^[12-14] The practice of unscrupulously advising laboratory tests before elective surgical procedures lacks concrete scientific evidence. There is very little scientific literature supporting relevance of these tests in terms of clinical utility in apparently healthy individuals (American Society of Anesthesiologists [ASA] 1 and 2) before the surgical procedure.^[13-15] The Practice Advisory released by Task Force of the ASA in 2002 that updated again in 2012 clearly mentions ordering of preoperative laboratory tests be preceded by complete evaluation of patients medical records, patient interview, and physical examination along with the type and degree of invasiveness of the procedure proposed.^[16] In 2003, the National Institute for Health and Care Excellence released guidelines based on systematic review conducted by Munro *et al.*, which were revised and updated again in 2016.^[17-19] The guidelines for preoperative tests were based on specific type of surgery and ASA grade. Preoperative tests such as full blood count, hemostasis, kidney function tests, and ECG are not routinely recommended in minor to intermediate surgeries in ASA 1 and 2 patients. The guidelines provide recommendations

on preoperative testing in patients above 16 years of age with the aim of reducing unnecessary test requests offered to patients before minor, intermediate, and major surgeries, keeping in mind cardiovascular, diabetes, obesity, renal, and respiratory comorbidities.^[18]

The literature searches highlighted a systematic review by Munro *et al.* which clearly mentions the counter-productiveness of various tests of hemostasis.^[18] Routine bleeding time (BT), prothrombin time (PT), and partial thromboplastin time (PTT) in clinically healthy patients have shown abnormality in various ranges (3.8% for BT, 4.8% for PT, and 15.6% for PTT). Regardless of abnormal findings, management remained unchanged in most surgical procedures.^[20-27] Similar observations were made with regard to blood electrolytes, renal function tests, and blood glucose (biochemistry) in other significant systematic reviews [Table 1] and studies [Table 2].^[28-44] Another systematic review by Czoski-Murray *et al.* deals with some pertinent questions on clinical effectiveness and cost-effectiveness of the routine preoperative laboratory tests in ASA 1 and 2 patients, undergoing minor to intermediate elective surgery.^[29] Johansson *et al.*, 2013 in their systematic review, made comparable conclusions from other high-quality studies stating the lack of evidence supporting routine preoperative testing in otherwise healthy adult patients. They also recommend need for large-scale multicenter random clinical trials to explore clinical effectiveness of preoperative testing compared to no testing in patients with low-risk elective surgeries, for more conclusive statements.^[31] The

authors of the current review are also of the same opinion, as more systematic research would be helpful in better evidence-based policy-making for clinicians and hospitals. In a retrospective study conducted on 2000 patients undergoing elective surgery, Kaplan *et al.* concluded that 60% of routinely ordered tests could be avoided if the clinician relied on the history and examination, since only 0.22% of these revealed abnormalities that may have led to a change in the perioperative management of the patient.^[33] Contrary to this, the study by Correll *et al.* and others have concluded that preoperative evaluation along with laboratory tests can aid in identification and resolving of underlying unknown medical issues that can have positive effect on the overall patient management, but tests should be requested judiciously as shown in Table 2.^[42-45]

A detailed evaluation of patients undergoing OMF procedures follows the same principles as for any other surgical procedure elsewhere in the body. Wagner and Moore published a comprehensive review on the relevance of preoperative testing in OMF surgeries. The article discusses the WHO criteria, which emphasizes on the evaluation of overall general condition of the patient before advising the laboratory tests. The advised test should have clear indication in terms of morbidity and mortality and at the same time should have significant impact on the overall management of the patient. The review discusses limitations of laboratory tests in terms of its sensitivity and specificity and their inability to detect the underlying abnormalities (false negative) accurately or

Table 1: Systematic reviews assessing routine laboratory investigations in preoperative evaluation

Author	Preoperative tests	Conclusions
Wagner and Moore, 1991 ^[7]	ECG, X-ray, CBC, Hb and coagulation tests, LFTs, RFTs, TFTs, and urine analysis	Preoperative test results of abnormalities had no influence on the clinical management of patients
Munro <i>et al.</i> , 1997 ^[18]	ECG, X-ray, CBC and coagulation tests, biochemistry, and urine analysis	There is no good evidence that abnormal preoperative test results of X-ray, ECG, CBC, hemostasis, electrolytes, creatinine, and urinalysis abnormalities rarely lead to change in clinical management of patients
Fattahi, 2006 ^[8]	CBC, platelet, WBC, Hb, coagulation tests, blood glucose, LFTs, RFTs, pregnancy test, and urine analysis	Clinically relevant conditions are recognized during the history and physical examination without the need for further laboratory testing
Kumar and Srivastava, 2011 ^[28]	ECG, X-ray, CBC and coagulation tests, serum creatinine, electrolytes and blood glucose	Performing routine tests in all surgical patients as a screening tool is of little value and expensive
Czoski-Murray <i>et al.</i> , 2012 ^[29]	FBC, electrolytes, renal function and pulmonary function in adult patients classified as ASA 1 and 2 undergoing elective Grade 1 or Grade 2 surgical procedures	Absence of published evidence supporting routine use of these tests in patients falling in ASA 1 and 2
Keay <i>et al.</i> , 2012 ^[30]	Preoperative testing (ECG, X-ray, CBC, and various serum parameters)	Routine preoperative testing was not found to increase the safety of a patient undergoing cataract surgery
Johansson <i>et al.</i> , 2013 ^[31]	Preoperative renal function tests, urine analysis, electrolyte tests, liver function testing, and pregnancy testing, blood gases, Hb and hematocrit testing. Pulmonary evaluation: Spirometry, and chest X-ray	No evidence available from high-quality studies that supports routine preoperative testing in healthy adults undergoing noncardiac surgery Large RCTs required for better evidence and conclusion
Balk <i>et al.</i> , Agency for Health Care Research and Quality, 2014 ^[32]	Preoperative testing (ECG, X-ray, CBC, coagulation tests, metabolic panels, and urine analysis)	Insufficient evidence on impact of preoperative tests before surgeries or perioperative complications, cancellations or delays

ECG: Electrocardiogram, CBC: Complete blood count, Hb: Hemoglobin, RFTs: Renal function tests, LFTs: Liver function tests, WBC: White blood cell, FBC: Full blood count, ASA: American Society of Anesthesiologist, RCTs: Randomized controlled trial, TFTs: Thyroid function tests

Table 2: Studies assessing routine laboratory investigations in preoperative evaluation

Author	Preoperative tests	Conclusion
a. Studies having views that oppose routine preoperative tests in general surgery		
Kaplan <i>et al.</i> , 1985 ^[33]	CBC, differential cell count, PT, PTT, BT, Hb platelet count, and glucose level	This retrospective study showed that routine preoperative laboratory tests contribute little to patient care in the absence of any specific indications and could be removed
Blery <i>et al.</i> , 1986 ^[5]	Blood group, antibody screening, Hb, PT, PTT, BT, platelet count, blood glucose, creatinine, ECG, chest X-rays	This prospective study on ASA 1-4 patients showed that preoperative test is not negligent provided that the request matches with the patient's clinical features
Turnbull and Buck, 1987 ^[34]	ECG, chest X-ray, CBC, Hb, coagulation tests, FBG, creatinine, electrolytes, and urine analysis	This prospective study on ASA 1 and 2 patients of cholecystectomy showed that preoperative tests provided little information that could not be obtained by history and physical examination that would alter management in otherwise healthy patients undergoing surgery
Mancuso, 1999 ^[35]	ECG, chest X-ray, CBC, Hb, coagulation tests, FBG, creatinine, electrolytes, and urine analysis	This prospective study showed that the decrease in preoperative testing did not result in any intraoperative or postoperative adverse effects and was cost-effective
Johnson and Mortimer, 2002 ^[36]	ECG, chest X-ray, CBC, Hb, coagulation tests, FBG, creatinine, electrolytes, and urine analysis	This retrospective study showed that, outcome could not be predicted by routine tests, anesthesia rarely altered, high cost
Bryson <i>et al.</i> , 2006 ^[37]	ECG, chest X-ray, CBC, Hb, coagulation tests, FBG, creatinine, electrolytes, and urine analysis	This retrospective study on ASA 1 and 2 patients showed that, majority of the elective surgery patients undergo preoperative testing most tests are normal and management is affected in only 2.5%
Ranasinghe <i>et al.</i> , 2010 ^[38]	ECG, chest X-ray, CBC, Hb, coagulation tests, FBG, creatinine, electrolytes, and urine analysis	This prospective study showed that unnecessary preoperative investigations are common and lead to substantial excess costs
Garcia <i>et al.</i> , 2014 ^[39]	ECG, chest X-ray, CBC, Hb, coagulation tests, FBG, creatinine, electrolytes, and urine analysis	This retrospective study on ASA 1-4 patients showed that, preoperative tests are not always ordered within clinical criteria, resulting in increased cost for the institution
Keshavan and Swamy, 2016 ^[40]	ECG, chest X-ray, CBC, Hb, coagulation tests, FBG, creatinine, electrolytes, and urine analysis	In conclusion, this retrospective study showed in ASA 1 and 2 patients that certain unindicated tests are requested due to lack of conclusive evidence, and so, there is an urgent need for developing guidelines for preoperative tests in Indian context
Akwasi <i>et al.</i> , 2017 ^[41]	CBC, coagulation tests, electrolytes, RFTs and LFTs	This prospective, cross-sectional study on ASA 1-4 patients undergoing elective surgery showed that lot of laboratory investigations requested for patients undergoing surgery at their hospital had no clinical indication
b. Studies having views that support routine preoperative tests		
Perez <i>et al.</i> , 1995 ^[42]	ECG, chest x-ray, CBC, Hb, coagulation tests, FBG, creatinine, electrolytes, and urine analysis	This retrospective, multicenter study on ASA 1-3 patients showed that selective and rational preoperative tests were needed and routine tests were of little value
van Klei <i>et al.</i> , 2002 ^[43]	ECG, chest X-ray, CBC, Hb, coagulation tests, FBG, creatinine, electrolytes, and urine analysis	This retrospective study Concludes that an increase in the quality of perioperative care as a result of a reduction of cancelled surgery, hospital admission time, and preoperative testing
Correll <i>et al.</i> , 2006 ^[44]	ECG, chest X-ray, CBC, Hb, coagulation tests, FBG, creatinine, electrolytes, and urine analysis	This retrospective study showed that, the preoperative evaluation helps in identifying and resolving a number of medical issues that can impact efficient operating room resource use
Shah <i>et al.</i> , 2007 ^[45]	Hb%, BT, CT, and urine microscopy	This prospective study on ASA 1 ENT patients showed that, there was significant correlation with routine investigations in elective ENT surgery. Authors also suggested restricted use of preoperative tests to reduce the financial burden to improve health care system
Akwasi <i>et al.</i> , 2019 ^[46]	CBC, Coagulation Studies, LFT and RFT	This prospective study on ASA 1 surgery patients concluded that, preoperative tests should be ordered judiciously by anaesthetists supplemented by physical examination and history.
c. Studies on routine preoperative tests in oral and maxillofacial surgery		
Haug and Reifeis, 1998 ^[50]	FBG, CBC, Hb, and urine analysis females -beta Human chorionic Gonadotropin	This prospective study on patients undergoing routine dentoalveolar surgery concluded that a good history and physical examination and then reassessment were sufficient to plan the surgery and anaesthetic treatment.
De Silva <i>et al.</i> , 2013 ^[51]	ECG, chest Xray, CBC, Hb, coagulation tests,	This is a retrospective study highlighting the absence of clear guidelines for preoperative tests.

CBC: Complete blood count, PT: Prothrombin time, PTT: Partial thromboplastin time, BT: Bleeding time, Hb: Hemoglobin, ECG: Electrocardiogram, FBG: Fasting blood glucose, RFTs: Renal function tests, LFTs: Liver function tests, ASA: American Society of Anesthesiologists, CT: Clotting time, ENT: Ear, nose and throat

raising caution by false-positive results; this contributes to additional cost and discomfort to the patient.^[7]

Fattahi in his review on preoperative laboratory and diagnostic testing highlights age of the patient as one of the important

criteria for advising preoperative tests.^[8] Although age remains an independent factor in decision-making process, the other factors are ASA status and type of surgical procedure.^[47-49] As observed by Munro *et al.*^[18] routine preoperative tests are not competent in anticipating postoperative outcomes in asymptomatic patients,

Table 3: Surgical classification system based in maxillofacial spectrum

Category (type of surgical procedure)	Morbidity/mortality risk	Maxillofacial surgeries
Minor	Patient at minimal risk with little or no blood loss	Cyst enucleation Implant surgeries Preprosthetic surgeries Incision and drainage for space infections under short general anesthesia Mandible fractures
Intermediate	Patient at minimal to moderate risk with blood loss <500 ml	Open reduction for condylar neck fractures Cleft lip and palate surgeries LeFort I and II fractures Orthognathic surgeries Temporomandibular joint surgeries
Major	Patient at moderate risk with blood loss 500-1500 ml	LeFort III and complex panfacial trauma Craniofacial surgeries
Complex	Patient at high risk with blood loss >1500 ml	Oral cancer surgeries Emergency trauma with head injury
Source ^[8]	Adapted and modified from:- Fatahi, Perioperative Laboratory and Diagnostic Testing—What is Needed and When? Oral Maxillofacial Surg Clin N Am 2006;18:1 – 6.and NICE guidelines	

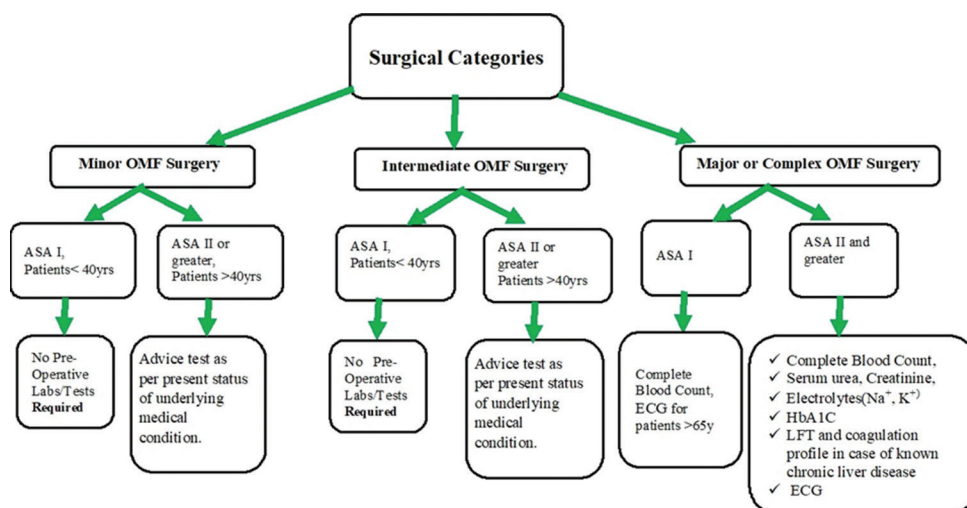


Figure 1: Indications for routine preoperative laboratory testing for oral and maxillofacial surgery based on age, American Society of Anesthesiologists, and surgical classification system

except in certain well-defined groups such as patients beyond a certain age.^[34] Similar observations have been reported by other authors in context to OMF surgery.^[2,50,51] As observed by Wagner and Moore, majority of procedures performed by OMF surgeon fall into ASA 1 and 2 categories, most of whom are young.^[7] Keeping these observations in mind, authors of the current review suggest a working algorithm (utilizing the classification of surgical procedures in maxillofacial spectrum) proposed by the authors that incorporates the ASA category, type of surgical procedure, and age of the patient as essential criteria for the selection of preoperative laboratory tests [Figure 1 and Table 3]. The proposed algorithm and table are recommendations in the form of screening tool for choosing appropriate preoperative laboratory tests; the authors suggest further studies to substantiate clinical validity of the same.

CONCLUSION

By ordering battery of tests before surgeries, anesthetists and clinicians generate ample information about the current status of the patient. This information in authors' view, which is substantiated by present review, has limited influence on the overall management and outcome of elective maxillofacial surgical patients. Guidelines are now in place and emphasize careful selection of preoperative laboratory tests based on personalized case. In authors' observation, excessive data generated through unmindful "one for all, all for one" attitude of clinicians need immediate shift, as this leads to unnecessary procedural delay, lack of overall patient satisfaction and trust.

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Conflicts of interest

There are no conflicts of interest.

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