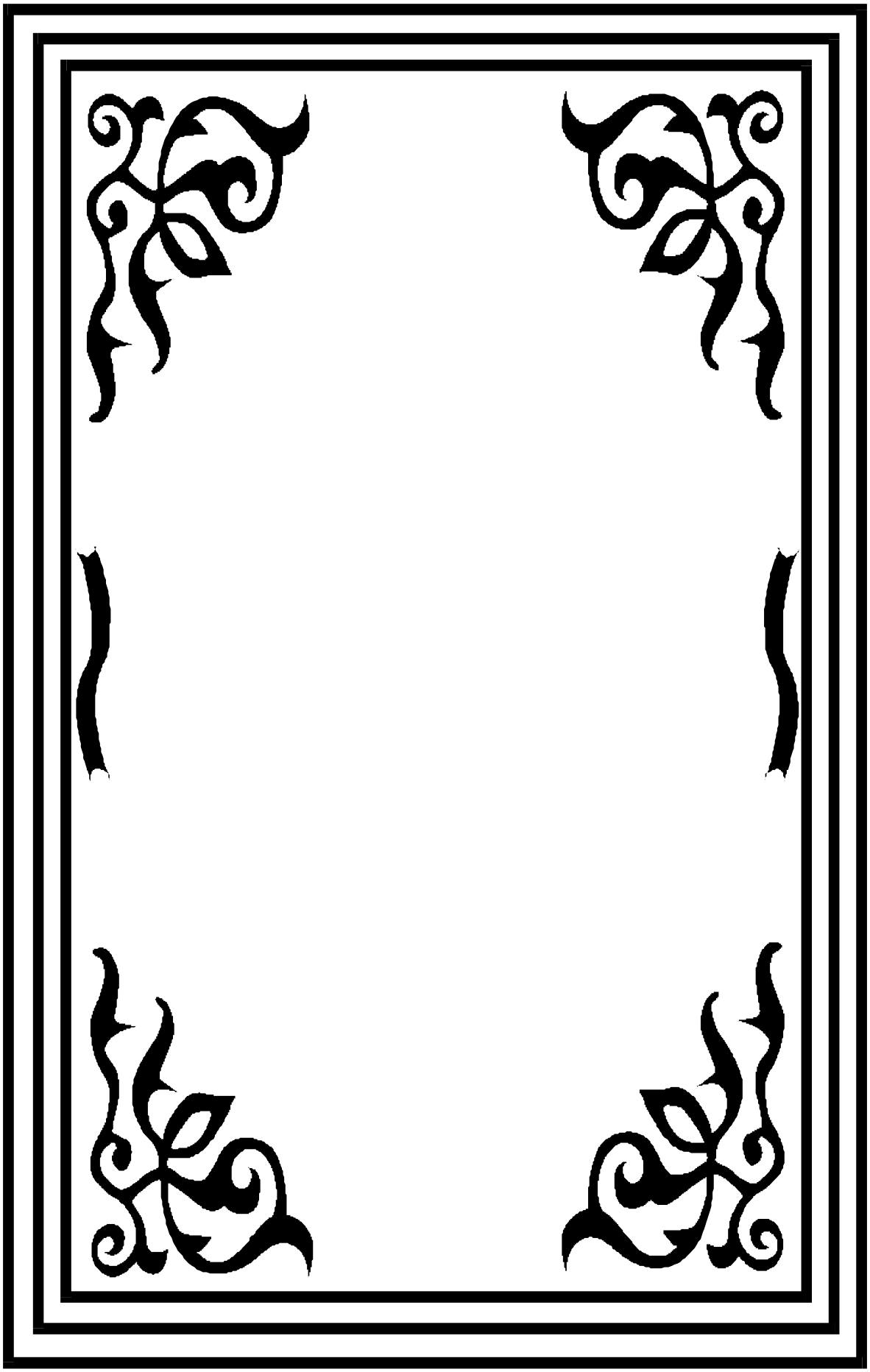
بسم الله الرحمن الرحيم

(قَالُوا سُبْحَانَكَ لا عِلْمَ لَنَا
إِلَّا مَا عَلَّمْتَنَا إِنَّكَ أَنْتَ
الْعَلِيمُ الْحَكِيمُ)

(سورة البقرة:32)



Introduction: -

Perioperative analgesia is a major concern for the patient and for the anesthesiologist ,whose task is to avoid pain. There is increasing interest in peripheral nerve blocks (PNBs), single or continuous , mainly for perioperative treatment of unilateral surgery **(Grossi and Urmey, 2003)**. They provide intense ,site-specific analgesia and are associated with a lower incidence of side effects when compared with many other modalities of analgesia **(Evans et al ., 2005).**

Many of the challenges and clinical failures of regional anesthetic techniques can be attributed to fact that neurovascular anatomy is highly variable .Furthermor ,current nerve localization techniques provide little or no information regarding the anatomical spread of local anesthesia **(Sites et al .,2008).**

PNB, despite its well known clinical benefits, has not gained popularity .This is secondary to multiple shortcomings including a defined failure rate , lack of simplicity, and the potential for patient discomfort or injury **(Sites and Brull,2006)**

Conventional methodology for nerve location utilizes anatomical landmarks followed by invasive exploration with a needle to a suitable endpoint .An appropriate endpoint can be either anatomical in nature (e.g transarterial technique) or functional (parasthesia or motor response to electrical stimulation) **(Urmey, 2006)**.the electrically ideal position of the needle usually is defined by motor responses which can not be interpreted without profound anatomical knowledge **(Birnbaum et al, 2007).**Nerve stimulation can also be used in uncooperative patient and in

anesthetized individuals,although the risk of intraneural injection of local anesthetic is not eliminated in such cases **(Andres et al, 2005).**

The appearance of new techniques and devices is increasing,such as percutaneous electrode guidance,ultrasonographic localization of neural structures,and the use of stimulating catheters **(Grossi and Urmey, 2003)**.Recently,ultrasound technology has been utilized by anesthesiologists in an attempt to minimize many of the drawbacks of traditional nerve block techniques **(Sites et al, 2008),** This technique has many clinical benefits for regional anesthesia including short time of procedures,easy recognition of peripheral nerves and surrounding structures and decreased incidence of complications **(Ogawa, 2002)**

Recent studies have shown that direct visualization of the distribution of local anesthetic with high-frequency probes can improve the quality of the block and avoiding the complications. Ultrasound guidance enables the anesthetist to secure an accurate needle position and to monitor the distribution of the local anesthetic in real time **(Marhofer et al, 2005)**

Aim of the work

To compare between the electrical and ultrasound guided nerve detection for peripheral nerve block, this will help the anesthesiologist to practice safe and effective peripheral nerve blocks.

Chapter 1

Introduction to peripheral nerve blocks

The techniques of peripheral neural blockade were developed early in the history of anesthesia The American surgeons,*(**Halsted and Hall, 1885)*** described the injection of cocaine into peripheral sites, including the ulnar, musculocutaneous, supratrochlear, and infraorbital nerves, for minor surgical procedures in the 1880s. ***(Corning, 1885)*** recommended the use of an Esmarch bandage in 1885 to arrest local circulation, thus prolonging the cocaine-induced block and decreasing the uptake of that local anesthetic from the tissues. This concept was furthered by Heinrich F.W. ***(Braun,1903)*** who substituted epinephrine, a "chemical tourniquet," in 1903.

Whereas early discoveries in regional anesthesia involved surgeons and basic scientists, the developing specialty of anesthesiology gradually dominated the use of regional anesthetic techniques. ***(Golden, 1900)***

Peripheral neural blockade is now a well-accepted component of comprehensive anesthetic care. Its role has expanded from the operating suite into the arena of postoperative and chronic pain management With appropriate selection and sedation, these techniques can be used in all age groups. Skillful application of peripheral neural blockade broadens the anesthesiologist's range of options in providing optimal anesthetic care (***Braun, 1914)***

Uses of peripheral nerve block

The skillful use of nerve blocks is important as a diagnostic, prognostic, and therapeutic tool in the management of chronic and acute problems. ***(Black and bonica, 1975)***

1- Diagnosis

Neural blockade is an important tool in the evaluation of chronic pain when used as an adjunct to a detailed history and physical examination. ***(Hartrick, 2003)***

Local anesthetic neural blockade (LANB) can be very valuable in determining the pathway or mechanism of pain. The anatomic source of the pain can be diagnosed with a variety of LANB techniques. Joint pain resulting from cancer can be diagnosed with intra-articular injections. Sympathetic blocks can be used to diagnose sympathetically mediated pain and to guide treatment.(**Wallace et al, 2003)**lective nerve root injections may be helpful as a diagnostic tool in evaluating spinal pain with radicular features ***(Datta et al, 2007)***

2- Prognosis

Before any permanent neurolytic procedure, it is recommended to perform a prognostic local anesthetic block on the nerve to be ablated.

Unfortunately, the prognostic value of long-term pain relief from a positive LANB is not guaranteed. However, a negative LANB almost certainly predicts failure, thus supporting the use of the prognostic LANB before an ablative procedure. ***(Wallace et al, 2003)***

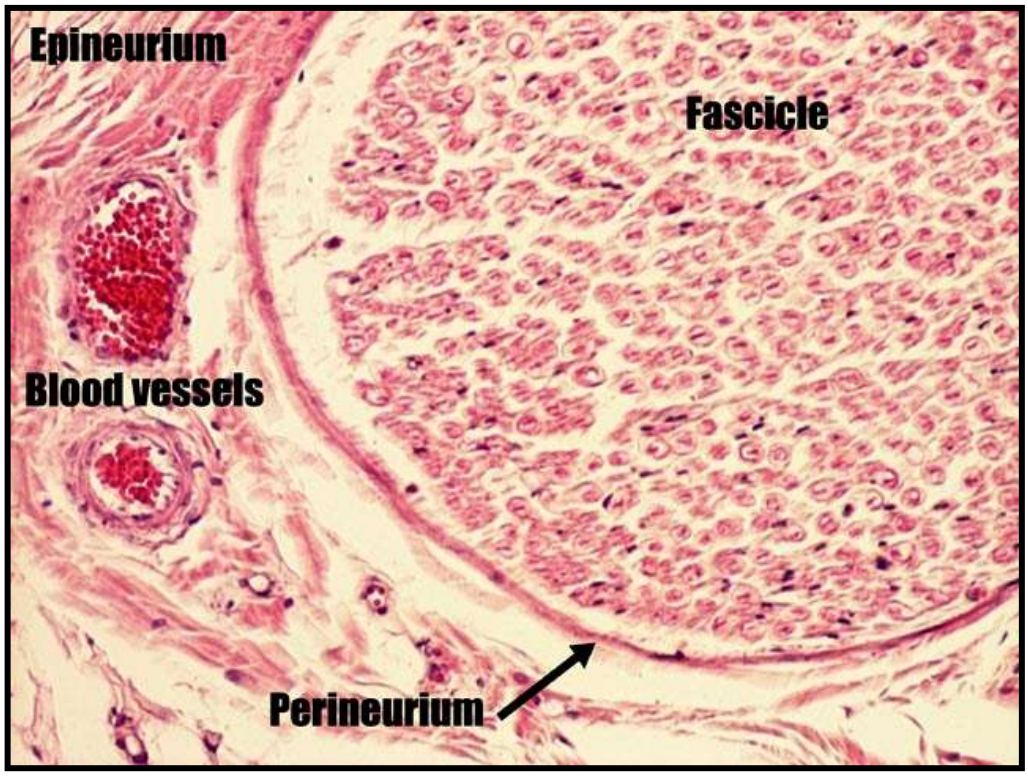
3- Therapy

For somatic malignant or nonmalignant chronic pain syndromes, Para vertebral blocks can be useful both diagnostically and therapeutically. **(Greengrass et al, 2003)** LANB is useful in the management of myofascial pain, sympathetically mediated pain, long-term treatments employing catheter techniques and continuous delivery, and in crisis management of severe pain. ***(Wallace et al, 2003)***

functional anatomy of Peripheral nerves :

The functional anatomy of the peripheral nerve is crucially important for understanding the mechanisms of peripheral nerve injury.A peripheral nerve is a complex structure consisting of fascicles held together by the epineurium, an enveloping external connective sheath (Fig.1). Each fascicle contains many nerve fibres and capillary blood vessels embedded in a loose connective tissue, the endoneurium. The perineurium is a multilayered epithelial sheath that surrounds individual fascicles. Nerve fibres depend on a specific endoneural environment for their function, this is different than the regular extraneural interstitium. Peripheral nerves are richly supplied by an extensive vascular network in which the endoneural capillaries have endothelial "tight junctions", a peripheral analogy to the "blood-brain barrier". The entire vascular bed is regulated by the sympathetic nervous system and its blood flow can be as high as 30 to 40 mL/100g per minute. In addition to conducting nerve impulses, nerve fibres also maintain axonal transport of various functionally important substances, such as proteins and precursors for receptors and transmitters. This process is highly dependent on oxidative metabolism. ***(Borgeat et al, 2007)***

Any of these structures and functions can be deranged during a traumatic nerve block and possibly result in temporary or permanent impairment or loss of neural function**.** ***(Borgeat,2006)***



1. Figure (1): **Histology of the Peripheral Nerve. (Sunderland, 1978)**.

Keys To Success With Peripheral Nerve Blocks (***Hadzic et al, 2002)***

the success with peripheral nerve blocks is undoubtedly more anaesthesiologist-dependent than is the case with neuraxial and general anaesthesia. The main determining factors for success wheather in blind or ultrasound guided regional block are considerd to be (***Kopacz and Bridenbaugh, 1993)*** **.**

-Patient selection

The patient to be a candidate for regional anaesthesia, factors such as the primary indication for surgery, the presence of a coexisting diseases, potential contraindications, and the patient's psychological state and patient education should all be considered. Regional anaesthesia, alone or in combination with general anaesthesia, is feasible and desirable in most surgical patients, in almost any operative site. There are only a few absolute contraindications to regional anaesthesia, such as patient refusal, the presence of an active infection at the site of the puncture, and, perhaps, true allergy to local anaesthetics (***Kopacz and Bridenbaugh, 1993)***

Regional anesthesia is particularly advantageous in high-risk surgical patients undergoing orthopedic, thoracic, abdominal, or vascular surgery. Patients with concomitant respiratory disease also benefit as using endotracheal intubation and mechanical ventilation are avoided. ***(Hadzic et al, 1998)***

-The Surgeon

An insightful, and educated surgeon is often the greatest advocate of regional anaesthesia. Nearly all patients undergoing various orthopedic, vascular, hand, and paediatric surgical procedures can be anaesthetized using regional anaesthesia. ***(Chan et al, 2001)***

Indeed, a discussion with the surgeon prior of choosing a regional anaesthetic technique is important. The discussion must include considerations regarding the site, nature, extent, and duration of the

planned surgical procedure.Thus, discussion of the use of a tourniquet is always necessary to make sure that the intended technique will be adequate for the planned surgery. (***Hadzic et al, 1998)***

-The anaesthesiologist

A confident, well trained, and charismatic anaesthesiologist is perhaps the single most important factor for the success of regional anaesthesia. For patient's acceptance, and successful initiation and conductance of a regional anaesthetic technique, it is primarily the anaesthesiologist's confidence and ability to establish a rapport with the patient that determines the success.Indeed, in the practice of anaesthesia , we do not present the patient with a range of anaesthetic options for the particular procedure, which is confusing to many patients. Instead, we propose to the patient a regional anaesthesia plan that is a deemed option based on the patient's physical status, planned procedure, surgical technique, and experience of the anaesthesia team. As the number and complexity of regional anaesthesia techniques keep increasing, it is clear that regional anaesthesia become a highly specialized subspecialty in anaesthesiology. (***Kopacz and Bridenbaugh, 1993).***

-The technique

a-Selection

Technique selection is of vital importance for the success of nerve block. Choosing, initiating, and conducting regional anaesthesia often requires more thought process than the conductance of a general anaesthesia. With general anaesthesia, regardless of the technique, drugs, or ventilation modes chosen, adequate anaesthesia is almost assured

because all patients are unconscious during the conductance of general anaesthesia. In contrast, otherwise successful regional blocks may fail to provide adequate operating conditions because the site and duration of the surgery, the need for tourniquet application, or appropriate perioperative sedation are not considered.

b-Premedication

Most patients are apprehensive about the pending anaesthesia and surgery. Therefore, prior to performing a peripheral nerve block, premedication is essential to alleviate anxiety and prevent unnecessary discomfort, as inadequately premedicated patients will move during the block placement, making it difficult to interpret responses to nerve stimulation and possibly cause dislodgment of the needle from its intended position, It should be noted that different block procedures are associated with varying degrees of discomfort, and thus premedication is adjusted for individual patients and the procedure. A narcotic analgesic is introduced only at the time of the needle placement thus alfentanil provides intense analgesia of short duration and it is the most commonly used narcotic for this purpose.(***Stein, 1993).***

All peripheral nerve blocks can be divided into two major group, Blocks associated with minor patient discomfort ("superficial" blocks) and blocks associated with more patient discomfort ("deep" blocks), thus, a sedation protocol should be chosen according to the regional anaesthesia technique planned and individual patient characteristics. For instance, interscalene brachial plexus block can be administered to a minimally sedated, fully alert and awake patient. On the other hand, an infraclavicular, sciatic, or lumbar plexus block necessitates, in most

patients, a greater degree of sedation and analgesia to ensure the patient's comfort and acceptance. Regardless of the sedation technique chosen, the goal of sedation is to provide maximum patient comfort while maintaining a meaningful patient contact throughout the procedure ***(*** **Shafer and Varvel, 1991)** (table 1,2)

Block Placement	**Sedation**
Blocks resulting in mild patient discomfort	
Cervical blocks Interscalene block Supraclavicular block Axillary block Posterior popliteal block	Midazolam 2-4 mg ± alfentanil 50-100 µg

(Table 1) Premedication in superficial blocks,(*Kopacz and Bridenbaugh , 1993)*

Block Placement	Sedation
Blocks resulting in more patient discomfort	
Infraclavicular block Wrist blocks Paravertebral blocks Lumbar plexus block Lateral popliteal block Saphenous block	Midazolam 4-8 mg ± alfentanil 500-1000 µg

(Table 2) Premedication in deep blocks (*Kopacz and Bridenbaugh, 1993)*

c-Precision

The two main factors for successful neuronal blockade are firstly successful localization of the nerve(s) and this become so easy by using an ultrasound and secondry the ability to maintain the needle in the same position while injection of the local anaesthetic is carried out.Two-hand immobile technique can be used , With this technique, the palpating fingers are firmly pressed in the desired anatomic location while the nonpalpating fingers are anchored on patient's body to prevent moving

of the fingers and changing the depth of palpation. The hand holding the needle is then positioned over the palpating hand with free fingers supported on the palpating hand or patient's body.

d-Equipments

The proper selection of the equipment, such as needles of appropriate length and a properly functioning nerve stimulator and siutable ultrasound machine and probes(if using ultrasound guided technique) is very important for successful block performance.

Insulated needles have differente designs among various manufacturers, resulting in clinically significant differences in stimulating characteristics, ease of advancement, and internal resistance. Although paraesthesia techniques are still taught in some centres, the techniques with nerve stimulators are more commonly used especially in lower extremity and continues nerve blocks. Nerve stimulators also provide useful information on the needle position, allow for an objective and logical needle redirection, and serve as an excellent educational tool for better understanding of the functional anatomy. Paresthesia techniques can be used with some upper extremity blocks. However, modern lower extremity and continuous nerve blocks can not be successfully practiced without nerve stimulation . Nerve stimulators with a remote (foot) control (Fig.2), which allows quick and frequent control of the current by a single anaesthesiologist is used nowadays. With advancement of ultrasound it became the most superior technique to be used in local techniques which offers precise location of the nerve and avoid injuring of nerves or its adjacent structurs .(***Bashein et al, 1984)***

e-Local anaesthetic selection

Selection of the type, dose, and volume and concentration of the local anaesthetic used plays a major role in successful neuronal blockade. Adequate volums and concentrations are important to ensure fast onset and complete blockade. However, unnecessarily high doses and concentrations should be avoided, particularly in elder and ill patients, in whom inadvertent intravascular injection of the local anaesthetic carries a much higher risk than in young and fit patients. Morever, high pressures and fast forceful injections should be avoided to decrease the risk of massive inadvertent "channeling" of the local anaesthetic into the systemic circulation.Indeed, utrasound guidance greatly avoid this inadvertent event. **(Kalichman. Et al, 1988)**

Fig(2) Foot controlled nerve stimulator **(New york school of regional anesthesia).**