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Research Article

Intravenous Locoregional Anesthesia: An Alternative of Choice in a Country with Limited Resources (Abidjan-Cote d'Ivoire)

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ABSTRACT

Background: ALRIV, a simple, reliable, inexpensive and easily reproducible technique, is still little practised in sub-Saharan Africa. The objective of this study is to describe our practice in order to popularize this anesthetic technique.
Methods: This was a prospective and descriptive study covering a 12-month period. All patients admitted for surgical management of upper limb except the arm and lower limb except the thigh were included. The parameters studied were epidemiological, clinical, therapeutic, anaesthetic and evolutionary.
Results: We selected 73 patients out of 675 (10.81%). The majority of the patients were seen in the framework of a regulated surgery against only 13.69% in emergency. The operative indications were: removal of osteosynthesis materials (52.05%), limb osteosynthesis (43.83%) and phlegmon evacuation (4.10%). The double tourniquet technique was used in (93.15%). Lidocaine 0.5% was used at a dose of 0.5ml/kg. The average duration of the procedures was 57.28 minutes. Postoperatively, all our patients received multimodal analgesia. In the postoperative monitoring room, 64.38% of patients did not experience any discomfort or pain.
Conclusion: ALRIV is a simple technique of peripheral local anaesthesia that is easy to teach, consistently effective and inexpensive.

Intravenous locoregional anaesthesia (ALRIV) or endovenous anaesthesia is a technique consisting of blocking sensitivity by intravenous injection of an anaesthetic at the level of the convergence of the large nerve trunks. It can be used for brief surgical procedures on the upper limb (hand, forearm or elbow) or on the lower limb (foot, leg or knee). ALRIV, which is a simple, reliable, inexpensive and easily reproducible technique with simple teaching, remains very marginal [1]. In our context, where financial means are often limited and operating theatres poorly equipped, ALRIV appears to be an obvious technique to adopt. However, in spite of these advantages, it is very little practised in the Ivory Coast, and national studies are non-existent. The major African series come from North Africa [2-3] and one may even wonder why it has been forgotten. With this in mind, through a series of 73 cases, we report our experience with the main objective of attracting many more practitioners to this technique in order to contribute to its popularization.

Methods

This was a prospective and descriptive study covering a period of 12 months (1 September 2018 to 30 August 2019). All patients admitted to the large operating theatre

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of the Yopougon University Hospital for surgical management of upper limb disorders except for the arm and lower limb disorders except for the thigh and classified as ASA I and ASA II were included. Patients with trauma whose theoretical management time exceeded 90 minutes, morbidly obese patients because of the risk of non-occlusion of vessels when the tourniquet is applied, haemoglobinopaths and/or patients with biological or clinical haemostasis disorders were not included. The parameters studied were epidemiological, clinical, therapeutic, anaesthetic and evolutionary.

We obtained the agreement of the hospital authority. The information collected for this purpose was guaranteed to be confidential. Informed consent was required from all patients. Our data were collected on individual survey forms entered and analysed with Epi info software version 7.2.

Description of the technique used:

CPA: Carried out the day before the operation or two days before for scheduled operations or in the emergency room on the day of the operation for emergencies, it is carried out in two stages: Questioning: In addition to socio-demographic data, the patient's past history was sought, in particular comorbidities (hypertension, diabetes, sickle cell anaemia), previous or current treatments, the use of anticoagulants, the patient's surgical and respiratory history.

The clinical examination assessed:

BMI in order to exclude morbid obesity

Hemodynamic constants and cardiovascular and respiratory functions

The need to prescribe a complementary assessment (biological and/or radiographic)

The clinical examination always ended with the patient's informed consent.

The pre-anaesthetic visit

This was carried out in the operating theatre in the patient preparation room. It was the place to reassure the patient about the course of the anaesthesia and, by extension, the surgical procedure.

Premedication

Carried out on the operating table after monitoring the patient's vital functions, it used a benzodiazepine, MIDAZOLAM at a dosage of 0.03 mg/kg to 0.05 mg/kg without exceeding 2 mg in a slow intravenous injection.

The technique for performing ALRIV

The equipment used consisted of:

A 24 or 22 G inflatron type trocar

A double pneumatic tourniquet

Two Esmarch strips

Two 20cc syringes

A bottle of 0.5% xylocaine.

The technique used was the double tourniquet technique using either a double air chamber pneumatic tourniquet or two single tourniquets (Esmarch strips) placed in series.

A safety line was taken from the contralateral limb and the antibiotic injected. A 22G or 24G catheter was placed on the distal end of the limb to be operated on (dorsal aspect of the hand or foot). After exsanguination by gravity and/or Esmarch bandage, the first tourniquet was placed at the proximal end of the limb to be operated on; the injection of the LA was done slowly at a dosage of 2mg/kg or 0.5 ml/kg of 0.5% lidocaine without exceeding 40 ml on the upper limbs and 60ml on the lower limbs. After surgical asepsis of the limb to be operated on, the operation began approximately fifteen minutes after the injection of the LA. The surgeon placed the second tourniquet (proximal tourniquet) in the anaesthetised area and the distal tourniquet was released thirty minutes after injection of the LA. Whatever the duration of the operation, the minimum tourniquet time was 30 minutes.

Postoperative analgesia was started a few minutes (15 min) before the planned end of the procedure and the patient was taken to the ICU at the end of the procedure.

Monitoring

Active monitoring was performed in the ICU for one hour. Vital signs were recorded and pain intensity was assessed. The patient was then either taken to an inpatient room or discharged after 3 hours of monitoring.

Results

Epidemiological characteristics

We selected 73 patients out of 675 (10.81%). The sex ratio was 3.29. The mean age was 36.2 years with extremes of 17 and 65 years. The (30-40) age group was the most represented (36.98%). The majority of patients had a low socio-economic level (61.64%) and came from the trauma department (71.23%), the emergency department (16.43%) and their home (12.32%) respectively.

Table 1- Epidemiological characteristics

Parameters	Numbers	Percentage
Age		
Young subject	18	28,75
Adult	51	69,86
Elderly subject	4	5,47
Source		
Emergency	12	16,43
Traumatology	52	71,23
Home	9	12,32
Socio-économic level		
low	45	61,64
Medium	17	23,28
High	11	15,06

Clinical and Para-clinical characteristics

More than eighty-five percent of the patients were seen in the framework of a regulated surgery against only 13.69% in emergency. The medical history was dominated by hypertension (19.17%) and diabetes (8.21%). Eighty-three percent of the population had an ASA I score while the others had an ASA II score. The operative indications were: removal of osteosynthesis

materials (52.05%), limb osteosynthesis (43.83%) and phlegmon evacuation (4.10%). The main tests performed were blood count (100%), rhesus blood group (95.89%), prothrombin level (75.30%) and activated partial thromboplastin time (71. 23%). Regarding preoperative preparation, almost all (95.89%) of the patients were fasting, 43.83% received premedication (Table 2).

Table 2- Clinical and paraclinical features

Parameters	Numbers	Percentage
Type of surgery		
Scheduled	63	86,30
Urgent	10	13,69
History		
None	53	72,60
HTA	14	19,17
Diabetes	6	8,21
Indications		
AMO	38	52,05
Osteosynthesis	32	43,83
Phlegmons	3	4,10
ASA		
ASA I	61	83,56
ASA II	12	16,43

Therapeutic and evolutionary characteristics

The tourniquet technique used was double tourniquet (93.15%) or single tourniquet (6.85%). The exsanguination technique used was Esmarch tape (95.89%) or gravitation (4.19%). Lidocaine was used in all patients without adjuvants. The average procedure time was 57.28 minutes with extremes of 25 minutes and 98 minutes. During this study, we encountered two cases of incomplete anaesthesia and five cases of agitation related to tourniquet intolerance. In the postoperative period, all our patients received multimodal analgesia using paracetamol (83.56%), morphine and its derivatives (58.90%), non-steroidal anti-inflammatory drugs (43.83%), Nefopam (42.46%) and tramadol (39.71%) as the main products. In the post-procedure monitoring room, 64.38% of patients had no discomfort or pain while 35.61% had moderate to severe pain controlled by analgesia. Sixty-six patients or 90.04% of the study population underwent outpatient surgery (Table 3).

Table 3- Therapeutic and evolutionary characteristics

Parameters	Numbers	Percentage
Number of goldneyes		
Double	68	93,15
Single	5	6,84
Means d'exsanguination		
Esmarch band	70	95,89
Gravitation	3	4,10
Duration of intervention		
[00-30 min]	3	4,10
[30-60 min]	41	56,16
[60-90 min]	26	35,61
[> 90 min]	3	4,10
Incidents		
None	66	90,41
Intolérance to tourniquet	5	6,84
Incomplete Anesthesia	2	2,73
Analgesic		
Paracétamol	61	83,56
Morphines et dérivés	43	58,90
AINS	32	43,83
Nefopam	31	42,46
Tramadol	29	39,72

Discussion

In our study we recorded 73 cases out of a total of 675 orthopaedic surgery procedures, i.e. a ratio of 10.81%. This low ratio, which has been observed in several African series, could be due to the lack of training of practitioners in this technique associated with the absence of a written protocol [2-3].

The average age in our study was 36.2 years with extremes of 17 and 65 years. The age range of 30 to 40 years was the most represented. Our results are close to those of A. Mahmoudi and Hanafi who obtained an average age of 40 and 41 years respectively. This can be explained by the youth of the African population and the high prevalence of trauma in young subjects [2-3].

The sex ratio (M/F) was 3.29. Mahmoudi in Morocco found a male predominance of 73%. This male hegemony is confirmed by the fact that males are the usual population for road trauma [2].

More than eighty-five percent of the patients were seen in the context of a controlled surgery. This result is similar to that of Mahmoudi, who found 73% in favour of controlled surgery. The limited number of practitioners capable of performing ALRIV makes it difficult to perform in emergency [2].

ALRIV on the lower limb concerned three cases out of seventy-three, i.e. 4.10% of our population. In the study by Laxenaire MC, it represented less than 8% of peripheral locoregional anaesthesias compared to 33% for the upper limb [4]. Also in France, according to a survey of field practices concerning peripheral locoregional anaesthesia, only 8 doctors out of 29 perform ALRIV on the lower limb for ankle and foot surgery with a tourniquet on the calf [5]. We have not found any cases of ALRIV in the lower limb in the African series [2-3], as there is a greater risk of complications in the lower limb due to the toxicity of local anaesthetics. A larger dose of local anaesthetic must be injected. On the other hand, the tourniquet is often even less well tolerated at the root of the limb. Finally, leakage under a tourniquet in the lower limb is more important [6]. All this means that ALRIV in the lower limb is probably riskier, less well tolerated, with a lower success rate and shorter duration.

Eighty-four percent of the population was classified as ASA I. This is lower than Mahmoudi's result of 93% [2].

The prevalence of ASA 1 in these studies is a result of the low prevalence of history and the youth of the population.

A biological preoperative work-up was systematically prescribed. The rate of completion of this test ranged from 71.23% to 100%, whereas in Mahmoudi only 8% of patients had undergone a biological test [2]. In fact, the biological check-up is not essential for the performance of peripheral locoregional anaesthesia. This high rate found in our series can be explained by the fact that the biological check-up was prescribed by the surgeon even before requesting the anaesthetist for the preanaesthetic consultation (CPA).

Almost all of our patients had observed the rules of the preoperative fast. Indeed, the usual rules of preoperative fasting are still mandatory to be respected. This is to prevent inhalation of gastric contents in cases where failure of the LRA would require a GA to be performed, or if the patient was unwell, whether of vagal, toxic or other origin [7].

Pre-medication on the morning of the procedure was not systematic; only 43.83% of patients received it. It was based on a short half-life benzodiazepine and was never carried out as an outpatient, as it was likely to prolong the time to discharge from hospital [8]. In Mahmoudi's series [2] all patients were premedicated with oral hydroxyzine on the morning of the operation. Premedication was also systematic in the Hanafi study [3], either with oral hydroxyzine for the operative programmes or IV midazolam for patients operated on in an emergency. According to the recommendations of the SFAR, there is no particularity for premedication in the context of peripheral ALR in adults. It must be adapted to the patient.

The technique used was the double tourniquet 93.15%. This was the Esmarch band placed in series. This technique solves the problem of tourniquet-related pain and is still the most widely used in practice [9].

In only three cases was exsanguination performed by simple elevation of the limb. In 95.89% of cases, exsanguination was achieved by centripetal rolling with an Esmarch band. However, gravitation is also effective in obtaining 90% exsanguination, as explained by Estèbe [10].

Lidocaine 0.5% was the local anaesthetic used. The same is true for Mahmoudi [2]. Some authors have used Ropivacaine as a local anaesthetic because of its shorter half-life and the quality of the anaesthetic. However, it does not have a marketing authorisation for this indication [11].

We did not use any adjuvant to lidocaine, as did Mahmoudi [2]. In the literature, the products used as adjuvants remain controversial. Clonidine remains the only product recommended by the SFAR for the tolerance of the tourniquet and the postoperative analgesia it provides [12]. However, it has been implicated in the occurrence of convulsion during ALRIV [13].

The average duration of the operation in our series was 57.28 minutes with extremes of 25 and 98 minutes. It is clearly lower than that of Mahmoudi and Hanafi which was 75 min. It is in line with the theoretical duration of interventions under ALRIV which should not exceed 90 min [2-3].

In our study, the release of the tourniquet was rapid, in one piece in most cases, i.e. 87.67% against 12.32% for the progressive release, contrary to that of Mahmoudi [2] where the deflation was done intermittently with at least two re-inflations. This is the method recommended by Esbete, as it allows the peak plasma concentration of LA to be smoothed out by reducing the maximum concentration (Tmax) and delaying its appearance in order to prevent toxic accidents [10]. Our technique was justified by the fact that we did not have a pneumatic tourniquet. Moreover, according to B. Cunin, 47.89% of French doctors practising ALRIV do not observe the progressive release of the tourniquet [14]. There were seven cases of intraoperative sedation (9.57%) due to intolerance of the tourniquet or incomplete anaesthesia. We used a hypnotic and a short half-life morphine (Propofol and fentanyl) with a Ramsay 3 objective. According to Koscielniak-Nielsen, not sedating the patient can be very uncomfortable and leave him with a bad memory of the anaesthesia [15]. The light sedation performed in our study was aimed at avoiding the risk of memory for the patient. Mahmoudi [2], in his series of 194 patients had achieved 7 GA conversions, i.e. 3%, while Hanafi [3], in his series of 500 cases, found 3% failures, essentially cases of incomplete anaesthesia. In a series of 11,229 ALRIVs performed in France, three cases of convulsions were observed without any other severe complication [16]. ALRIV therefore remains a simple, reliable and safe technique according to all studies.

Multimodal analgesia combining different analgesic levels (54.79%) or balanced analgesia combining level 1 analgesics and NSAIDs was started about fifteen minutes before the end of the procedure. Our result is similar to that of Mahmoudi in Morocco [2]. Indeed, the absence of residual analgesia at the lifting of the tourniquet imposes for the comfort of the patient to start analgesia before the planned end of the operation [17].

All our patients were admitted to the ICU at the end of the operation where the average length of stay was one hour. At present, some publications suggest the feasibility and safety of fast-tracking [18]. Indeed, the time elapsed between the end of the injection, the performance of the surgery and the exit from the block is generally greater than the maximum duration of local anaesthesia. Several authors have therefore opted for the bypass of the ICU, which consists of taking the patient out of the operating theatre without passing through the

ICU [19]. In our study, the purpose of the bypass was to ensure good analgesia on leaving the OR. In the study by R. Fuzier in France on ALRp in orthopaedics, the average length of stay in the ICU was 29 +/- 26 min for patients operated on under peripheral locoregional anaesthesia and was the place where intravenous or oral analgesia was administered for patients operated on under peripheral locoregional anaesthesia [20].

Conclusion

ALRIV is a simple technique of peripheral local anaesthesia that is easy to teach, consistently effective and inexpensive. Its disadvantages, such as the intolerance of the tourniquet and the lack of postoperative analgesia, can be improved by using suitable equipment and precise protocols for the management of postoperative pain. It is an attractive and beneficial technique in the context of full stomach emergencies, in patients at risk and especially in our conditions where almost the entire population has no medical cover.

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