

NORMAL LEG COMPARTMENT PRESSURES IN ADULT NIGERIANS USING THE WHITESIDES METHOD

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ABSTRACT

In Caucasians, the range of normal intracompartmental pressure of the leg is from 0 mmHg to 15 mmHg. In the literature, such measurements have not been done in Africa to identify normal leg intracompartmental pressures. We have sought to identify the normal range of pressures in such a population of Nigerians, and to demonstrate the reproducibility of the Whitesides injection technique with materials that are easily available in most hospitals so that compartment syndromes could be identified promptly and inexpensively in developing countries. We performed a 16-month hospital-based prospective study at Wesley Guild Hospital in Ilesa, Osun State, Nigeria, to measure the intracompartmental pressures in the anterior and deep posterior compartments of 49 contralateral uninjured legs of patients with closed contralateral tibial fractures, measured at presentation. The Whitesides infusion technique was used with the aim of determining the normal range of compartmental pressure in Nigerians. The anterior compartment pressures ranged from 3 mmHg to 18 mmHg with a mean 7.6 ± 2.6 mmHg. The pressure in the deep posterior compartment ranged from 3 mmHg to 14 mmHg with mean of 7.4 ± 2.7 mmHg. The values are similar to those reported in the literature. There was no statistically significant difference between the pressures in the two compartments ($p = 0.668$).

INTRODUCTION

The fascial compartments of the limbs have unyielding walls and contain compressible neurovascular structures.¹ The leg has four compartments—anterior, lateral, superficial posterior and deep posterior.² Among Caucasians, both experimental and clinical experience has demonstrated that normal tissue pressures within closed compartments range between 0 to 15 mmHg.^{3,4,5,6,7,8}

The objective of this work was to determine the average normal compartmental pressure in the legs of Nigerians using the simple pressure-measuring devices advocated with Whitesides.⁹

METHODS

This was a prospective hospital-based study of the measurement of compartmental pressure in the legs of adults that presented at the Wesley Guild Hospital (WGH). The WGH is located in Ilesa in the southwestern part of Nigeria within a major road network linking various parts of Nigeria. The hospital serves part of Osun state and is a referral center to the states of Ekiti, Ondo and part of Edo. Approval was obtained from the Obafemi Awolowo University Teaching Hospitals, Research and Ethical Committee.

Consecutive adult patients who were aged 16 years and above presented to the Accident and Emergency Department of WGH over a course of 16 months with unilateral closed tibial fractures. In fully resuscitated patients, consent was obtained for the measurement of normal compartmental pressures of both anterior and deep posterior compartments of contralateral uninjured legs of 49 patients with closed tibial fractures.

Excluded from the study were patients with soft tissue injury to the contralateral site of the fractured tibia. The measurement was done using the Whitesides' technique.⁹ The procedure was carried out under aseptic conditions with the patient supine.

The data obtained was analyzed with Statgraphic software package version 5.0 (Statistical Graphics Corp. Inc., Rockville, MD). An average of two readings for each compartment was taken and presented in the frequency table (Table 1).

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TABLE 1
Frequency distribution of compartmental pressure in adult Nigerian legs

Compartmental pressure (mm/Hg)	Frequency for Anterior Compartment	Frequency for deep posterior compartment
3	1	2
4	5	6
6	14	15
7	2	3
8	15	11
9	1	1
10	7	5
11	1	0
12	2	3
13	0	1
14	0	2
18	1	0
TOTAL	49	49

RESULTS

Over a sixteen-month study, 151 patients with tibial fractures were treated at the Wesley Guild Hospital Ilesa. Forty-nine had unilateral closed tibial fractures. There were 34 males (69.4%), and 15 females (30.6%) (M:F = 2.3:1).

The anterior compartmental pressure in the uninjured legs ranged between 3 mmHg and 18 mmHg with a mean of 7.6 ± 2.6 mmHg. The deep posterior compartmental pressure was 7.4 ± 2.7 mmHg with a range of 3-14 mmHg. The frequency distribution of the compartmental pressure in anterior and deep posterior compartments is shown in Table I.

There was no statistically significant difference between the anterior and the deep posterior compartments ($p = 0.668$). Using Spearman correlation coefficient, there was correlation between the measured anterior and deep posterior compartmental pressures ($r = 0.36$, $p = 0.014$).

DISCUSSION

Since the first reported measurement of compartment tissue pressures by Landerer in 1884, many measurements done with different measurement techniques have been used to measure intracompartmental pressure.⁸ In this study, the simple Whitesides injection technique was used. Literature provides no data as to what constitutes the range of normal intracompartmental pressure in a West African patient population, although we hypothesized that they would be similar to data in Caucasian patients. The results obtained from this study are, in fact, similar to normal compartmental pressures obtained in six patients by McDermott in Halifax,

Canada, who found the normal supine intracompartmental pressures using Solid-state Transducer Intracompartment Catheter (STIC) to be 7 ± 2 mmHg.⁴ The San Diego group reported that this value is less than 10 mmHg.^{3,5,6} Puranen reported an average compartmental pressure of 15 mmHg as the upper limit of normal.⁷ Matsen found the anterior compartmental pressure to be 11.5 ± 0.5 mmHg in seven normal limbs.⁸ The intracompartmental pressures measured in seven patients in the studies done in Halifax and six patients in Washington are comparable to those in our 49 Nigerian patients in this study. Even though sophisticated and more modern equipment was used in determining the intracompartmental pressure in most of these other studies, the values obtained in this study using a simple Whitesides infusion method fall within the previously reported range. Also, larger numbers of patients were studied in our group than the six or seven in the previously mentioned studies. Concerns have been raised that the Whitesides method could generate falsely high pressure readings¹⁰, but Clayton evaluated this injection technique by applying known pressures to the extremities of six rabbits with a pneumatic cuff, showing a good linear correlation with a slope of 1.03 ($r = 0.99$)¹¹ The advantage of the Whitesides injection technique is that it uses materials that are easily available in most hospitals, and this technique can be used in developing countries to promptly detect compartmental syndrome.

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