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Records at the Hyperbaric Medicine Division, USAF School of Aerospace Medicine, were reviewed to determine the utility of the pressure cuff test as an aid in the diagnosis of Type I decompression sickness (DCS). Applying local pressure with a blood pressure cuff has been described as a useful test to differentiate the pain of DCS from that of other musculoskeletal conditions. Records were reviewed from January 1985 to December 1989. During this period 179 patients were treated with recompression for extremity pain. In 87 patients, application of a blood pressure cuff to the painful area was used as a diagnostic aid. Only 53 patients with DCS, or 61%, had a positive test (relief of pain with local pressure). Results did not correlate with the rapidity of relief of symptoms during recompression. The conclusion is that the failure to respond to the application of local pressure should not be used to rule out the presence of DCS - this must be done with a test of pressure in a hyperbaric chamber.

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TECHNICAL NOTE

The Use of the Pressure Cuff Test in the Diagnosis of Decompression Sickness

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RUDGE FW, STONE JA. *The use of the pressure cuff test in the diagnosis of decompression sickness.* Aviat. Space Environ. Med. 1991; 62:266–7.

Records at the Hyperbaric Medicine Division, United States Air Force School of Aerospace Medicine, were reviewed to determine the utility of the pressure cuff test as an aid in the diagnosis of Type I decompression sickness (DCS). Applying local pressure with a blood pressure cuff has been described as a useful test to differentiate the pain of DCS from that of other musculoskeletal conditions. Records were reviewed from January 1985 to December 1989. During this period 179 patients were treated with recompression for extremity pain. Application of a blood pressure cuff to the painful area was used as a diagnostic aid in 87 patients. Only 53 patients (61%) with DCS had a positive test (relief of pain with local pressure). Results did not correlate with the rapidity of relief of symptoms during recompression. We conclude that the failure to respond to the application of local pressure should not be used to rule out the presence of DCS—this must be done with a test of pressure in a hyperbaric chamber.

DECOMPRESSION SICKNESS (DCS) is a physiologic syndrome which occurs as a result of excessive tissue nitrogen levels following exposure to changes in ambient pressure. In 1660, Robert Boyle was the first to note the harmful effects of acute changes in atmospheric pressure when he noted the formation of bubbles in the eye of a decompressed viper (1). Since then, many reports have been written on development of DCS in caisson and tunnel workers (2), divers (3), and aviators (4).

The most common manifestation of DCS is Type I DCS (the bends, joint pain only DCS). Among cases of DCS resulting from exposures in United States Air Force (USAF) altitude chambers, joint pain only has been noted in 69% (5). The pains of DCS are indistinguishable from the pains of other musculoskeletal disorders, such as inflammatory diseases or trauma. The pain of DCS is usually described as a deep seated aching or burning pain, which may or may not change with movement. Vigorous rubbing or application of local pressure to the affected area often results in a temporary decrease in pain. The pressure cuff test is performed by placing a blood pressure cuff over the affected joint and inflating the cuff to above systolic pressure. Diminution of pain with application of the cuff, which recurs when the cuff pressure is released, is considered a positive test. To our knowledge, pain due to decompression sickness is the only pain which has been shown to decrease with application of local pressure.

This study reviews the USAF experience with the pressure cuff test as a tool to rule out DCS as the cause of limb pain following flying or diving. To our knowledge, no prior studies have been done on the sensitivity of the pressure cuff test in the diagnosis of decompression sickness.

METHODS

A review was conducted of patient records maintained at the United States Air Force School of Aerospace Medicine, Hyperbaric Medicine Division. This division maintains files on all patients treated in USAF hyperbaric chambers, including the treatment of DCS. For this study, records were reviewed for the 5-year period from January 1985 to December 1989. During this period, 310 patients were treated for DCS, of whom 179 had extremity pain suitable for use of the pressure cuff test (i.e., pain involving the elbow, wrist, knee, or ankle). Patients with Type II DCS were included in the study if symptoms included pain in an extremity joint. Review of the narrative summaries and AF Form 361 (Chamber Reactor/Treatment Report) on these patients revealed that 87 patients had the pressure cuff test performed on the involved joint. Information obtained from each record included patient age, sex, joint affected, etiology of DCS (diving, flying, or altitude chamber), results of the pressure cuff test, treatment used, and time to resolution of symptoms with recompression therapy. Collected data were entered on a microcomputer for compilation.

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RESULTS

Among the 87 patients with DCS who had the pressure cuff test, 76 (87%) were male. Altitude chamber exposure was the cause responsible for DCS in 89% of cases. The remainder of cases were due to diving (9%) or flying (2%). The mean age of individuals treated was 26.2, with a range of 18 to 56 years.

The results of the pressure cuff test, by affected joint, are shown in Table I. The test was considered positive if the joint pain was partially or totally relieved with application of the cuff, and negative if pain was unchanged or increased. The pressure cuff test was positive in 61% of all cases. Among individual joints, the test was positive most frequently in the elbow at 71%. The variation in pressure cuff results in the different joints, however, is not statistically significant (chi-square (3 df) = 4.12, p = 0.249). Pressure cuff results were also unrelated to sex (chi-square (df = 1) = 0.215, p = 0.643), and to cause of DCS (chi-square (2 df) = 1.68, p = 0.431).

The results of the pressure cuff test were also analyzed to assess its value in predicting the response to compression therapy. Complete resolution of pain occurred in every case. In patients with a positive pressure cuff test, the mean time to resolution of symptoms was 33 min. In patients with a negative test, the mean time was 29 min. The difference in these groups is not significant (one-factor ANOVA, p = 0.653).

DISCUSSION

Decompression sickness is a well-known hazard of diving and flying. Unfortunately, the joint pains of DCS are nonspecific, and cannot be distinguished from many other causes of joint pain. Any individual developing joint pain following exposure to significant hyperbaric or hypobaric pressures should be considered to have decompression sickness until proven otherwise by a test of pressure. To date, no other reliable means is available to diagnose or treat DCS.

Application of pressure to the affected joint has been shown to cause the joint pain of DCS to decrease. Lansing noted in 1944 that joint pain from DCS developing in altitude chamber occupants could be alleviated by inflating a sphygmomanometer cuff around the affected joint (6). He noted that the amount of pressure required to give relief was variable. The pressure required for relief varied from 20 mm Hg to 190 mm Hg. Lansing noted that application of local pressure in 27 subjects with DCS caused total relief in 23 and partial relief in 4. In seven of the subjects, pain relief persisted after the pressure was removed.

Shilling (7) notes that the inflation of a blood pressure cuff above arterial pressure around an extremity joint, either at the surface or at depth, may relieve the pain and help confirm the diagnosis in a diver with DCS. Edmonds, in his text on diving medicine, also notes that the pressure cuff test may be of diagnostic value in patients with DCS (8). Hills uses the ability to relieve joint pain in DCS patients as evidence that the pain is caused by mechanical stretching of periarticular tissues by evolved bubbles of nitrogen (9).

In our experience with the pressure cuff test, the test is positive in only 61% of patients with DCS-related joint pain. Were the pressure cuff test used as the sole criterion to make the diagnosis of DCS, we would estimate that it would miss 39% of cases, which makes this test unacceptable for this purpose. Because records are not available on patients having the pressure cuff test who did not have DCS-related joint pain, no statement can be made on the specificity of the test. However, because the pressure cuff test would not be expected to be positive in a patient without DCS, the specificity of the test would be expected to be high. Therefore, a positive test should be considered as useful to confirm a diagnosis of DCS, but a negative test should not be used as a means to rule out DCS. The results of the pressure cuff test do not correlate with the speed of resolution of symptoms during recompression, and are, therefore, of no prognostic value in this regard.

TABLE I. RESULTS OF THE PRESSURE CUFF TEST.

Joint involved	Number of cases	Number positive (%)	Number negative (%)
Knee	55	34 (61%)	21 (39%)
Elbow	21	15 (71%)	6 (29%)
Ankle	7	3 (43%)	4 (57%)
Wrist	4	1 (25%)	3 (75%)
Total	87	53 (61%)	34 (39%)

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