

TENSION PNEUMOCEPHALUS FOLLOWING EVACUATION OF SUBDURAL HAEMATOMA

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ABSTRACT

Three cases of a rare complication of tension pneumo-cephalus following evacuation of chronic subdural haematoma are described .this occurred in 15% of all cases of chronic subdural haematoma. Treated following installation of a CT scanner .the chronically compressed brain contributes to the ingress of this intracranial air .the increase in the brain bulk and gradual re-expansion of the brain ,in the early post –operative period ,competes with the trapped subdural air resulting in rise in intracranial pressure leading to neurological deterioration .burr hole was put on the skull wall .according to the site of the pneumocephalus and aspiration ,using a brain cannula which was modified with three-way connector has produced excellent results. All cases were operated in the AL.mosswy and AL.saad private hospitals during the years 2005-2008, as a retrospective study in the AL. Basrha city.

INTRODUCTION

A number of surgical procedures , simple one burr hole or two burr holes have been used for the treatment of symptomatic chronic subdural (SDH)⁽¹⁻⁶⁾ .there was best result were obtained by a minimal surgery sufficient to achieve evacuation of the liquid content ^(1,6,7) . In all patients who deteriorate or do not improve following surgery, the possibility of reaccumulation is considered , tension pneumocephalus (TPNC) is seldom recognised in such patients however with advent of CT scanning ,subdural TPNC following evacuation of chronic SDH has been reported though infrequently , but in increasing numbers in recent its pathogenesis and treatment remains debatable .

MATERIAL & METHODS

Among 20 cases of ch.SDH treated in the AL-mosswy and AL- saady private

hospitals has in AL-Basrha city. because of the CT scanning there were 3 cases of true tension pneumocephalus all these 3 cases of chronic SDH. TPNC following supratentorial in the supine position have been reported separately ,no drain is used after evacuation of chronic SDH, the patient is nursed in a 30 degree head down position for 48 hours following surgery and is well hydrated .A ct scan is performed if there is no improvement or if neurological deterioration occurs. if the CT scan shows significant amount of intracranial air in the presence of neurological , a twist drill craniostomy or burr hole and aspiration of the air using a brain cannula with three- way connector is performed. subsequent taps are similarly performed guided by the clinical status of the patient.

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DISCUSSION

The presence of intracranial air (pneumocephalus) following in post operative plain skull X. R or CT scans in the vast majority of cases the air is small in quantity, asymptomatic and is spontaneously absorbed. However, large asymmetric accumulation of air, when trapped under tension, may act as a space occupying lesion causing shift of the midline structures and brain compression resulting in neurological deterioration (tension pneumocephalus) (4-20). Pneumocephalus may be classified according to its location as epidural, subdural, subarachnoid, intracerebral or intraventricular (20-22). Subdural TPNC has been reported following CSF shunts (22,24), puncture drainage of brain abscess, ventricular drainage (26), craniotomy and posterior (9,28) fossa surgery. TPNC following evacuation of subdural haematoma has been commented upon infrequently (9,12,14). Tindala, reporting on complications (30) following surgery for chronic SDH, did not mention TPNC. Loew stated it to be an unusual and very rare complication. An unacceptably high incidence of 16% was reported by Bremer et al. whereas (11) Ishiwata et al. reported it to be 2.5%. We (15) have observed TPNC in 15% of the patients operated for chronic SDH. A burr hole craniostomy with closed system drainage has become a well recognized and most frequently used procedure for the treatment of chronic SDH. However (8), Kaufman considered drains to be unnecessary (30) if it is likely that as the contents of the haematoma are evacuated, air gains entrance intracranially in a fashion similar to negative cavity pressure, to suck the air from the environment. Failure of the chronically compressed brain to fully re-expand. Promptly and adequately and establishment of a flap-valve mechanism by plugging of the burr-holes by the underlying brain or subdural membranes also act as contributory factors (14). A significant amount of air may thus accumulate. The

trapped-air tends to rise to the most superior portion of the intracranial cavity and thus becomes inaccessible to removal prior to closure of the operative wound. Further expansion of the pneumo-coele possibly occurs when cooler room air, with differential partial pressures of oxygen, carbon-dioxide than in blood, gets warmed up to the patient's body temperature. Black stated that gas will expand by about 5% in going from room to body temperature. The slow differential absorption of nitrogen and equilibrium of the partial pressure of the oxygen and carbon-dioxide could increase gaseous volume, which may enhance the tension state (12).

A gradual re-expansion of brain following evacuation of SDH due to rehydration. Trendelenburg position and reaccumulation of the depleted CSF, competes for space with the trapped air resulting in an increase in the intracranial pressure with resultant focal or generalized neurological deterioration, brain oedema from irritation of the cortex by air possibly (4). Contributed to raised intracranial pressure.

Where TPNC developed in the presence of a relatively small amount of air, the time required for air to be absorbed is directly proportionally to its quantity (28). Hence a delayed TPNC can occur. A causal link between clinical deterioration and increased tension of subdural air must be shown to establish a definitive diagnosis of TPNC. Ishiwata et al (15) used air spouting through the burr-hole at reoperation as a sign of (true TPNC). CT scan suggests raised intracranial pressure in the presence of a mass effect produced by subdural air. Monajati et al (15) stated that a midline shift, if present, was often indicative of a mass effect in subdural TPNC, however, evaluation of this effect is difficult because the brain may remain distorted even after evacuation of chronic SDH. Midline shift was shown to be present in 50% of cases of asymptomatic pneumocephalus. Monajati et al. stated that more than 65

ml of subdural air could result in TPNC, but I Shiwata et al. found no significant difference in the volume of air in TPNC and asymptomatic pneumocephalus. They discussed the limitations of CT scan in assessing the mass- effect in bilateral TPNC and the difficulty in measuring the exact Volume of air. Several signs, like the peaking sign, air bubble sign and niveau -formation, have been described for TPNC but their absence does not exclude it⁽¹⁵⁾. Leundda et al claim that ventricle acts as a buffer, by reducing its Volume, when subdural air is under tension Dilorzen et al⁽²⁸⁾. labeled intracranial air as significant according to the compression of the frontal horns or lobes. In our patients, few of these signs were observed no definite logical diagnostic sign or a particular Volume of air sufficient to cause TPNC, can be spelled out since the vulnerability of the brain varies from Patient to patient depending upon status of intracranial contents and the intracranial pressure. A correlation between CT scan findings and neurological status of the patient is essential. The following criteria for diagnosis of "true TPNC" were observed in all the cases in the present series:

1. Presence of a significant amount of air within the cranium on CT scan and x-ray.
2. Neurological deterioration.
3. Immediate improvement in the neurological status following aspiration of the air.
4. Hissing sound on escape of air during evacuation.

Failure of the compressed brain to re-expand adequately and promptly, a well known basic problem following evacuation of chronic SDH observed by every neurosurgeon^(1,4,5) is an important factor that contributes to the Formation of TPNC. Good hydration and head-down position are frequently used to promote re-expansion, but their Limitations have also been clearly demonstrated⁽¹⁾. the simple expedient of creating negative pressure over the convexity of brain, placement of a T-

tube connected to Emerson suction at 8 mm Hg, Penrose drain, small rubber or silastic tube may help in re-expansion of the brain, but air can simultaneously get sucked in to the cranial cavity. Injection of fluid via the spinal subarachnoid space and intraventricular infusion of a physiological solution⁽⁵⁾ have also been advocated. However it can be dangerous to expand the brain in this artificial manner at a rapid rate-These techniques, with equivocal results, have generally been abandoned except as measures of last resort. Silver Clipor gelfoam tantalum dust placed on the dura and the brain surface respectively have been used to assess re-expansion⁽³⁰⁾, which can now be well documented by serial CT scans. Recently, flushing of subdural space with saline, placement of patient on 100% oxygen, substitution nitrous anesthesia before wound closure in the absence of brain re-expansion and slow saline cranial subarachnoid infusion have been advocated to prevent the development of the pneumocephalus^(14,29). TPNC has been successfully managed with conservative treatment⁽¹⁶⁾, twist craniotomy and simple needle aspiration⁽¹¹⁾, continuous lumbar subarachnoid infusion with craniostomy drainage, percutaneous catheter connected to negative pressure⁽¹²⁾ and craniostomy⁽¹⁴⁾ (exploration)^(27,29) conservative treatment is not suitable in these cases as re- expansion of brain is desirable to prevent reaccumulation of SDH. Lack of the adequate facilities and the clinical condition of the nation may preclude other more aggressive methods. The minimal amount of surgery used by us to accomplish evacuation of air has produced excellent results. It allows active aspiration of air at the same preventing ingress of free air.

CONCLUSION

1. A high index of suspicion is essential for an early diagnosis of TPNC in the post operative period following evacuation of chronic SDH

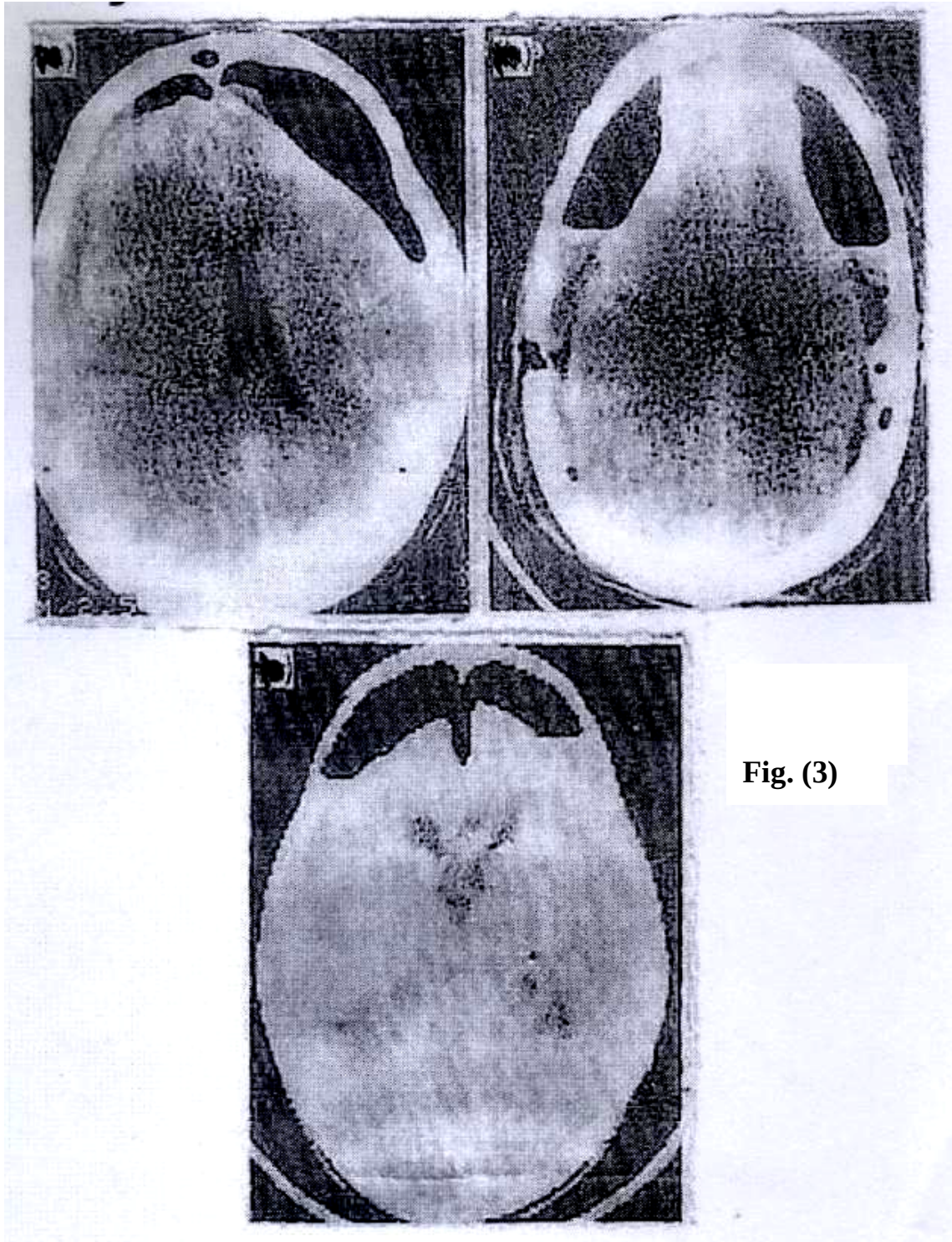
Tension Pneumocephalus Following Evacuation Of Subdural Haematoma

2. chronically compressed. Brain contributes to the ingress of intracranial air.
3. the increase in of the brain bulk and gradual expansion of the brain

competes with trapped subdural air resulting in a rise in intracranial pressure. Its prognosis, with the simple treatment described is excellent.

Fig. (1)

Fig. (2)



Example for the cases which were operated upon following drainage of ch. SDH .

Summary of 3 cases of TPNC following evacuation of ch. SDH

Case NO.	Age, sex	Pre-opneuro l status	Surgery	Contents	Post-operative neurol status	Hour interval	Neural status	CT / X ray	Treatment
1	60 m	Altered higher mental function	burr-holes	60ml altered blood	Conscious	10 h	semi conscious anisocoria hemiparesis	bifrontal PCN R> L fig.(1)	burr-holes and aspiration 60 ml under Tension
2	65 m	Altered higher mental function	burr-holes	70 ml altered blood	Conscious	6 h	drowzy	Bilateral PCN fig2	burr-holes and aspiration 30 ml air under Tension
3	10 F	drowzy	burr-holes bifrontal burr-holes	50 ml altered blood	Conscious	5 h	drowzy	bifrontal PCN	burr-holes and aspiration 40ml air under Tension

PNS: pnemocephalas

all 3 cases have improved result

M: male

F: female

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Tension Pneumocephalus Following Evacuation Of Subdural Haematoma

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استرواح الرأس الضاغط على الدماغ الذي يعقب عملية

بزل التجمع الدموي تحت غشاء الأم القاسية للدماغ

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الخلاصة

ثلاث حالات نادرة لاسترواح الدماغ (دخول الهواء إلى داخل الجمجمة) المصحوب بانضغاط مادة الدماغ كمضاعفات لعملية بزل التجمع الدموي المزمن تحت غشاء الأم القاسية للدماغ وكانت نسبة الحالات ١٥ % حيث تم تشخيصها بواسطة مفراس الدماغ وقد اظهر بأن انضغاط الدماغ يساهم في دخول هواء المحيط إلى داخل الجمجمة وأن الزيادة في حجم الدماغ مع تمدد الدماغ بعد بزل التجمع الدموي يساعد على اندفاع الهواء الخارجي إلى داخل الجمجمة مما يؤدي إلى ارتفاع الضغط داخل الجمجمة مع علامات سريريّة كضرر عصبي مركزي لذا كان التداخل الجراحي بواسطة تثقيب الجمجمة وسحب الهواء بواسطة (brian cannula) أعطت نتائج ممتازة وأن جميع هذه الحالات خضعت للتدخل الجراحي في مستشفى الموسوي الأهلي ومستشفى سعدي الأهلي للفترة من ٢٠٠٥-٢٠٠٨ كدراسة استرجاعية في مدينة البصرة.

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