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Sub-facial drain for CSF leak prevention pediatric lipomyelomeningocele

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Abstract
In our research we studied the sub-facial drain for cerebrospinal fluid CSF leak prevention pediatric Lipomyelomeningocele, the total operated of all cases number was 26, through the working time between (January 2016 and January 2022), and the period of inserted case (14 days), with common presentations gait problems and urinary problems. A specimens of cerebrospinal fluid (CSF) must be acceptable of round the spinal-cord within lumber puncture. The surgery was performed with subtotal lipoma removal with preservation of neuronal integrity with nerve intraoperative monitoring, the drain size was 8 French and Radi Vac. There is approximately 125ml of cerebrospinal fluid present at one time, producing about 500ml each day. The action of cerebrospinal fluid is to absorb shocks and reduce their severity, or as a buffer cushion, providing mechanical protection from external stimuli and basic immunological protection for the brain as a whole in the skull. Cerebrospinal fluid also maintains a pivotal action as the brain's own regulator of cerebral blood flow. The time of drain was 8 days, under conditions represented by (no CSf output, no wound swelling, and no subcutaneous collection of the CSF) of the removal drain.

Keywords: Sub-facial drain, cerebrospinal fluid, and pediatric lipomyelomeningocele

Introduction

A cerebrospinal fluid leak may occur when cerebrospinal fluid is trapped round the (humans' brain and spinal-cord), and may leak from the protective sac that surrounds it from the dura mater without any apparent cause. The dura mater is a tissue that is inflexible and durable, and it is considered the outermost layer among the three meningeal layers, and the meningeal system surrounds the brain and spinal cord together. A spontaneous cerebrospinal-fluid leak is caused by one\more holes in the dural tissue. Cerebrospinal-fluid may leak on its own rather than from an injury. This leads to a drop in pressure inside the skull known as intracranial hypotension. Most likely, cerebrospinal fluid leakage is characterized by orthostatic headache - (a headache that gets worse when the patient is standing upright, but improves when lying down) [1]. Other symptoms may include a stiff neck accompanied by pain, nausea accompanied by vomiting, fatigue, a metallic taste in the mouth (this indicates leakage in the skull), and other symptoms that indicate the occurrence of the disease. The x-rays can diagnose the exact location of the cerebrospinal fluid leak, to be controlled and treated in ways that suit the stability of the patient's condition. Spontaneously, the occurrence of cerebrospinal fluid leakage affects 5 people out of every 100,000 people in the world, on average, and this condition develops at the age of 42 years, while in women it is twice as likely to be infected, while in some people the disease becomes chronic, which makes It leads to prolonged disability due to pain. This condition was first described by the German neurologist Georg Schaltenbrand in 1938 and the American physician Henry Waltman of the Mayo Clinic. Generally, there is about (125-150 ml) of cerebrospinal fluid on a permanent basis, this cerebrospinal fluid circulates within the ventricular system of the brain, as the ventricles are a series of cavities filled with cerebrospinal fluid, and the majority of cerebrospinal fluid is produced within these two lateral ventricles. In it, the cerebrospinal fluid passes through the foramen between the ventricles to the third ventricle, then through the cerebral canal to the fourth ventricle, and from there the fluid passes to the subarachnoid space through four openings: (the central canal of the spinal cord, the middle aperture, and the two lateral apertures). The location of cerebrospinal fluid is within the subarachnoid space, which covers the brain and spinal cord and extends down the end of the spinal cord (the sacrum) [2, 3]. Cerebrospinal fluid normally moves in one direction outward from the ventricles, but it moves in multiple directions in the subarachnoid space. The fluid movement is pulsating, completely identical to the pressure-waves that are formed in the blood-vessels through the heartbeat [4]. Among the most common complications of meningocele repair is leakage of cerebrospinal fluid and meningitis, which is often associated with it, so there are many ways to prevent this dangerous disease, including multilayer sutures, early treatment of hydrocephalus, as well as a good repairing of the meticulous dura. Despite all these treatments, cerebrospinal fluid may eventually occur leading to wound dehiscence and inevitable meningitis if not treated properly.

Patients and methods

- From January 2016 to January 2022, we operated up on 26 cases who had LM period between 1 Year to 6 years.
- All cases prophylactic sub-facial drains was inserted for up to 14 days without use of Glue or any synthetic material.
- All cases develop no CSF leaks, no wound dehiecsnce and no meningitis.
- All cases operated in Imam AL-hussain hospital and Imam Alhuja hospital.
- Main period of presentation was 4 years.
- Common presentations were gait problems and urinary problems.

- Surgery was done with subtotal lipoma removal with preservation of neuronal integrity with nerve intraoperative monitoring.
- Drain size was 8 french and Radi Vac @ Drain was used with mean time of sub-facial drain was 8 days after good layered suturing without using glue.
- All cases healed without wound dehiscence or skin infection.
- Removal of the drain was jugeded based on: no CSf output, no wound swelling, and no subcutaneous collection of the CSF.

Results

75 % of cases, drained was removed at 7-8 days, 5 % within 3 days, 13 % after 2 weeks, 2 % re-insertion after drain malfunction or slippage.

Table 1: to show the percentage of drain removed cases, and the period of drain removed that required to each case

Percentage of drain removed cases.	The period of drain removed.
75 %	at about (7-8 days)
5 %	at about (3 days)
13 %	at about (2 weeks)
2 %	re-insertion after drain malfunction or slippage.

Table 2: to show the details of the research work, and its conditions.

Details of the research work, and the necessary conditions.	
Total operated cases number	26 cases.
The time that required for working	6 years (From January 2016 to January 2022).
The period of inserted case	14 days.
common presentations	gait problems and urinary problems.
How the surgery was performed with the most important conditions.	done with subtotal lipoma removal with preservation of neuronal integrity with nerve intraoperative monitoring.
Drain size	8 French and Radi Vac.
Drain time	8 days.
Conditions of the removal drain	no CSf output. no wound swelling, and no subcutaneous collection of the CSF.

Discussion

CSF and blood plasma have many similarities, even though CSF is normally almost protein-free compared to blood plasma and has some different electrolyte levels. Because of the way it is produced, cerebrospinal fluid has a higher level of chloride than plasma, and an equivalent sodium level not found in blood plasma [5]. Cerebrospinal fluid contains approximately (0.3%) of the proteins found in plasma, it reach to about (15-40 mg / dL), and in general, depending on the sampling site [6], globular proteins and albumin are in lower concentrations in the ventricular cerebrospinal fluid compared to others [7]. The continuous flow of fluids into the venous system reduces the total concentration of the larger fat-insoluble molecules that normally penetrate the brain, particularly the cerebrospinal fluid. Its normally, the cerebrospinal fluid is devoid of RBCs, and it has less than 5-WBCs per\mm^3, but if the number of white cells is higher than this amount, then this constitutes leukocytosis and therefore can indicate a Presence of specific inflammation or infection) [8, 9]. The symptoms resulting from the leakage of the cerebral spinal cord fluid are the reaction of the nerves and the optic nerve, which leads to blurring and unstable double vision. Most people who suffer from cerebrospinal fluid leakage suddenly feel a severe headache that is worse when standing, and the pain is worse when the person is in a vertical position and less severe when the horizontal position, and often this disease becomes chronic, making the sufferers unable to perform their daily work and unemployed, And the headache develops for patients with cerebrospinal fluid leakage in the afternoon as a second stage during the period of headache days. For about 50 % of patients suffer from pains in neck, nausea, and sometimes vomiting. Another symptoms are dizziness and facial-numbness. A cerebrospinal fluid leak can sometimes be seen when the fluid leaks through the nose or ear. In our study the percentages of drain removed cases, and the period of them shown in table no.1 arranged as (75 % , 5 %, 13 %, and 2 %), are take about (7-8 days, 3 days, 2 weeks, and re-insertion after drain malfunction or slippage) respectively, which illustrated in figure no.1. And all details of the research work, and its conditions shown in table no.2, represented by the periodic time that required for working, which is from January 2016 to January 2022, the period of inserted case reaches to 14 days, the common presentations are characterized by gait problems and urinary problems, the surgery was performed with the most important conditions done with subtotal lipoma removal with preservation of neuronal integrity with nerve intraoperative monitoring, the drain size was 8 french and Radi Vac, the drain time was 8 days, and the conditions of the removal drain were ; (no CSf output, no wound swelling, and no subcutaneous collection of the CSF) respectively. Cerebrospinal fluid leakage is one of the difficult and dangerous complications facing myofascial board. Sub-facial drainage is a cheap and easy way to prevent leakage of this cerebrospinal fluid by allowing the tissue to heal well so that there is not enough space between the layers of tissue for fluid to collect or leak through. Histologically the developing forebrain is surrounded by a nerve cord, and with the development of the fore brain, so the nerve cord with this section become a ventricle, then forms the lateral-ventricles. Within the inner-surface of each of these ventricles there is a thin wall, and as the choroid plexus develops, it will produce and release a fluid known as cerebrospinal fluid. The cerebrospinal fluid fills this neural canal rapidly, and the arachnoid villi are formed in a period of up to the thirty-fifth week of development that takes place, while the arachnoid granulations will occur in about the thirty-ninth week of the development period, and this development continues until the age of 18 months [10]. The human brain can produce approximately (500. ml) of CSF daily, this equal (25. ml per hour).

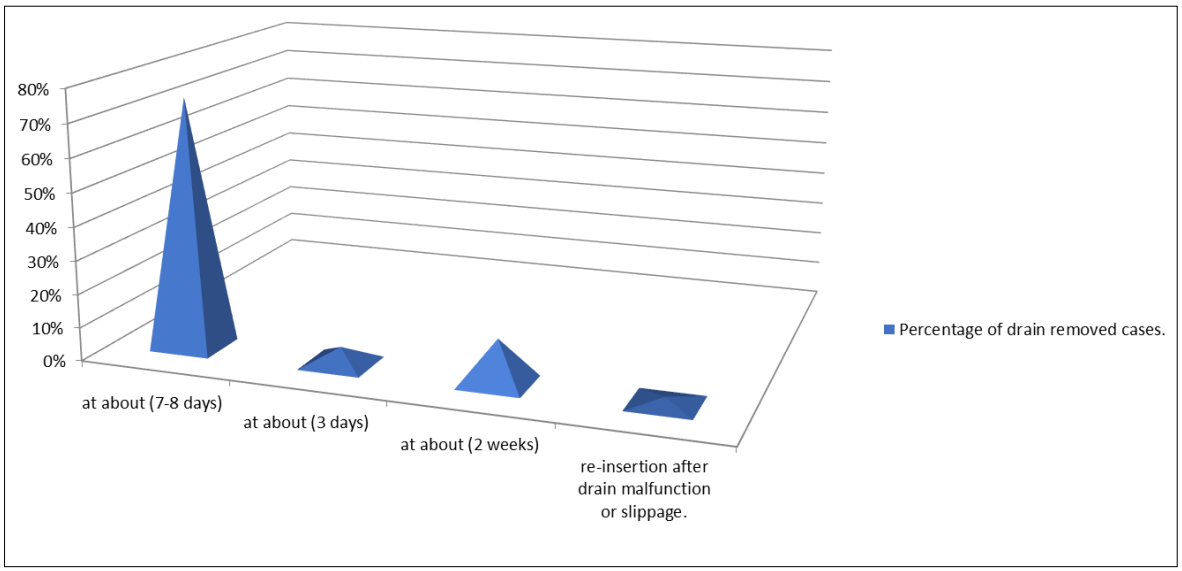

Fig 1: to illustrate the percentages and periods of drain removed cases.

The volume of cerebrospinal fluid is based on the basis of ml per kilogram of total body weight in children compared to adults. The total volume of cerebrospinal fluid in infants is estimated at about (4 ml / kg), while in children it is (3 ml / kg), but the volume of cerebrospinal fluid in adults is about (1.5-2 ml / kg) [11]. The large volume of cerebrospinal fluid is the reason for the need for higher doses than if local anesthesia, as a (ml/kg.) basis, had been used in infants.

Table 3: Comparison of serum and cerebrospinal fluid. Further information, list of reference ranges for cerebrospinal fluid (12).

Substance	CSF	Serum
Water content (% wt)	99	93
Protein (mg/dL)	35	7000
Glucose (mg/dL)	60	90
Osmolarity (mOsm/L)	295	295
Sodium (mEq/L)	138	138
Potassium (mEq/L)	2.8	4.5
Calcium (mEq/L)	2.1	4.8
Magnesium (mEq/L)	2.0–2.5	1.7
Chloride (mEq/L)	119	102
pH	7.33	7.41

Table No. 3 represents comparisons between the amounts of substances in each of the cerebrospinal fluid and serum in the body, which have been estimated globally and approved in scientific research [12]. Normally, the choroid-plexus produce approximately (80 %) of the CSF, and the choroid plexus can be defined as a blood-vessels network located in parts of the 4-ventricles that make up the human brain. Its located in the entire ventricular system except for the cerebral canal, and it must be known that the frontal and occipital horns possessed by the ventricles on both sides have the same feature. Cerebrospinal fluid is produced by other methods, such as from a single layer of cells lining the ventricles, which surround the subarachnoid space, and a small amount of vascular spaces around the brain [13].

Conclusion

We conclude from our current research that the possibility of obtaining the correct results depends on accuracy and experience in devising any method through which any problem can be addressed by patients who are exposed to a defect in the cerebrospinal fluid, even if the period of time for that is prolonged. It is possible that the cerebrospinal fluid leaks from the dura due to various factors, including physical trauma or lumbar puncture, or it can happen without any known reason, and thus it is called spontaneous cerebrospinal fluid leakage. Low intracranial pressure is usually accompanied by low cerebrospinal fluid pressure. This condition can cause a headache that worsens when standing, moving, and coughing.

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