Yadav *et al.*
The Egyptian Journal of Otolaryngology (2022) 38:85
https://doi.org/10.1186/s43163-022-00275-1

The Egyptian Journal of Otolaryngology

CASE REPORT Open Access

Cochlear implantation in hemophilia B—a rare case report

Chetan Yadav[1], Diva Sharma[1], Neeraj Suri[1*] and Meenesh Juvekar[2]

Abstract

Background: Hemophilia B is an X-linked inherited disease, mainly caused by deficiency of factor IX. Severity of the disease is manifested by the factor IX deficiency in the blood.

Case presentation: This paper presents our experience in the cochlear implantation with hemophilia B in an 11-month child with profound sensorineural hearing loss. The patient had normal hematological parameters pre-operatively and surgery was uneventful. After 36 h of the surgery, the patient developed right periorbital ecchymosis, extending to the left eye with a soakage of bandage. With timely early intervention, the bleeding stopped and ecchymosis was resolved.

Conclusion: To our knowledge, cochlear implantation in hemophilia B has not been reported previously. Cochlear implantation can be safely done in hemophilia A and B with timely correction of deficient factors.

Keywords: Hemophilia, Cochlear implant, Factor IX

Background

Hemophilia A and hemophilia B are recessive, X-linked bleeding disorders characterized by deficiency or absence of coagulation factor VIII (FVIII) or IX (FIX), respectively [1–3]. Hemophilia B is much less common than Hemophilia A, accounting for just 15–20% of the total hemophilic population. The two forms of the disease were historically thought to represent the same bleeding disorder, and it was not until 1947 that Hemophilia B was recognized as a separate entity [4, 5]. For some time after this, the condition was often referred to as "Christmas disease," after the name of the first patient examined in detail [5]. The classic manifestation of the hemorrhagic tendency in hemophilic individuals is bleeding into the joints and muscles [6]. The bleeding phenotype is typically categorized according to residual factor levels and is defined as severe (< 1% residual FIX), moderate (1–5% FIX), or mild (> 5 to < 40% FIX) [1, 2, 4, 6, 7].

The mainstay of treatment for hemophilia B consists of replacement therapy with plasma-derived or recombinant FIX (rFIX) concentrates, administered either on demand when bleeds occur or prophylactically in scheduled infusions. Clinically, hemophilia A and hemophilia B are often considered indistinguishable and have often been thought of as a single disorder [8]. Both are caused by deficiencies in an endogenous coagulation factor critical for the intrinsic coagulation pathway, and both show X-linked inheritance [3, 4, 6]. Each is characterized by a prolonged activated partial thromboplastin time and recurrent musculoskeletal bleeds [3, 4, 6], and treatment in both cases involves replacing the missing coagulation factor. The prevalence of hemophilia B is about a fifth that of hemophilia A.

Till date, no case has been reported of hemophilia B where a cochlear implant is being done. Cochlear implant is a routine surgery for kids who are born with profound sensorineural hearing loss. We here report a case of an 11-month-old child who was diagnosed with hemophilia B post-surgery and discuss the measures been taken to control bleeding.

*Correspondence: drneerajsuri@outlook.com

[1] Department of ENT, GMERS Medical College, Gandhinagar, Gujarat, India
Full list of author information is available at the end of the article

Case presentation

It is a case report of an 11-month-old male patient who was operated on in the department of ENT, GMERS, Medical College, Civil Hospital, Gandhinagar, Gujarat, India. The child had undergone a thorough otorhinolaryngological examination to ensure that he is free from any external and middle ear pathologies. Audiometric tests were performed using behavioral audiometry and electrophysiological tests including auditory brain stem responses, distortion product otoacoustic emission, and tympanometry. This was followed by radiological evaluation with HRCT temporal bone and MRI brain with the membranous labyrinth to rule out any inner ear anomalies. As a routine preoperative hematologic investigation, complete blood picture, bleeding time, clotting time, and prothrombin time was carried out and were in normal range. A right cochlear implant surgery was planned under general anesthesia. The surgery lasted for 45 min with no intraoperative and immediate postoperative complications. After 36 h of surgery patient developed periorbital swelling of the right eye (Fig. 1). We suspected it to be because of the tight bandage and the bandage was loosened. Within 6 h of this, the patient developed periorbital ecchymosis of the right eye spreading to the opposite eye with hematoma present over the right half of the scalp (Fig. 2). Simultaneously slight soakage of the bandage was noticed. The patient was taken to the operation theatre for dressing to look out for bleeding but the wound was healthy and the dressing was given. Within half an hour the bandage got soaked with blood. We suspected bleeding disorder and blood investigations along with activated partial thromboplastin time [APTT] were again sent. The hemoglobin dropped from 10 gm% to 4.2 gm%. Bleeding time, clotting time, and prothrombin time were normal and activated thromboplastin time [APTT] was found to be increased to 115 s [normal level is 30–36 s]. The hematologist was consulted and it was discussed to rule out factor deficiency. One unit of blood transfusion and two units of fresh frozen plasma along with an injection of tranexamic acid was given immediately. As the reports of factors VIII and IX were awaited, we decided to open the wound under general anesthesia to be sure of the presence of any bleeder as the hematoma was increasing. On opening the wound, the space above the periosteum was full of blood clots with oozing from every tissue. After the clots were removed, surgery

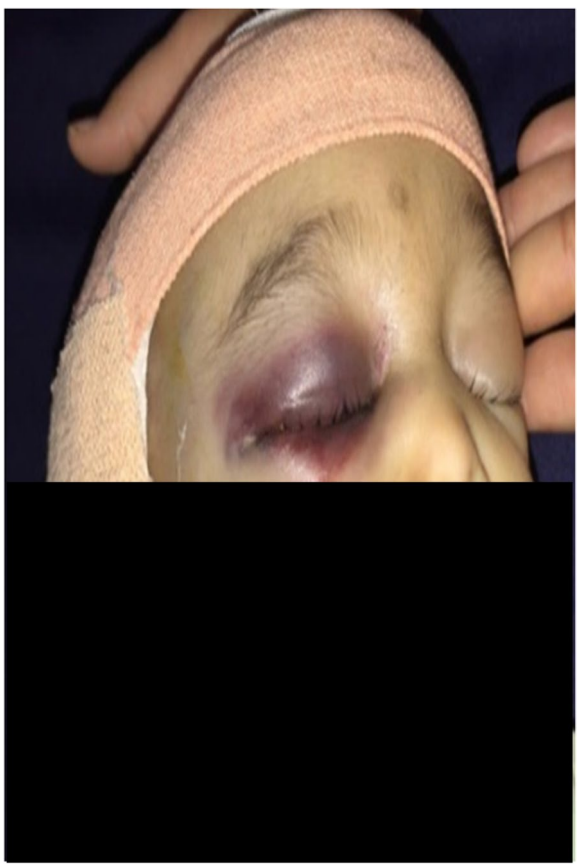

Fig. 1 Child developed unilateral periorbital ecchymosis after 36 h of surgery

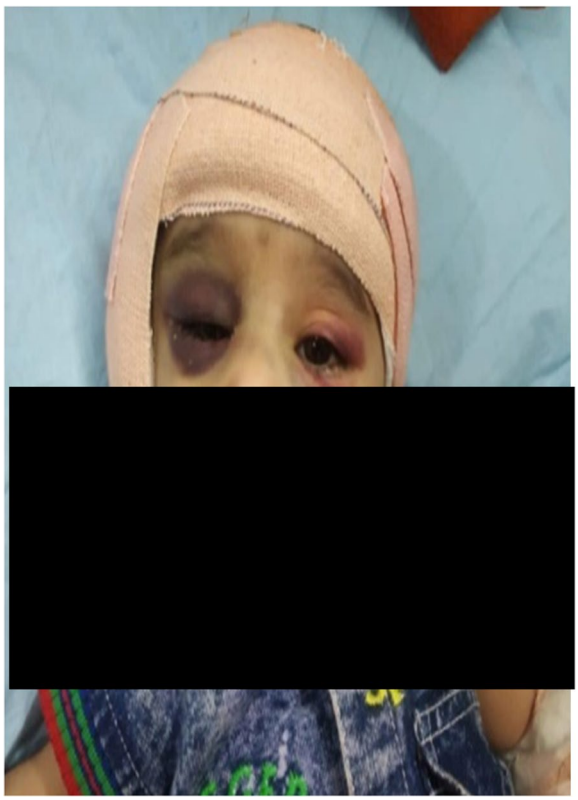

Fig. 2 Child developed bilateral periorbital ecchymosis after 42 h of surgery

was kept and the wound was closed in layers. Factor IX was found to be deficient and the patient was diagnosed with hemophilia B which is very rare. FIX was arranged in the hospital and one fresh frozen plasma and 1200 units of FIX were given to the patient immediately intravenously. The bleeding stopped after this correction and for the next 5 days, one fresh frozen plasma and 600 units of FIX were given daily. On hematologic investigations, the hemoglobin increased to 9 gm% and activated thromboplastin time was in the normal range after 2 days. The eyes slowly became normal and all hematoma was absorbed. The patient was discharged on the 10th day after suture removal. The child is healthy now and is undergoing rehabilitation (Fig. 3).

Discussion

Hemophilia is diagnosed either because of a known family history (which is absent in a third of hemophiliacs) or after presentation with bleeding. Most children with severe hemophilia are born uneventfully by vaginal delivery. Most children are free of symptoms until they learn to crawl or walk. The hallmark of severe hemophilia is spontaneous bleeding into joints and muscles, painful and destructive if inadequately treated. Most children with severe hemophilia experience their first bleed into a joint by age 4 years, but many bleed from other sites before this age [9]. Moderate hemophilia is diagnosed in most cases by the age of 5 years, but mild hemophilia may be diagnosed much later in life after trauma or surgery.

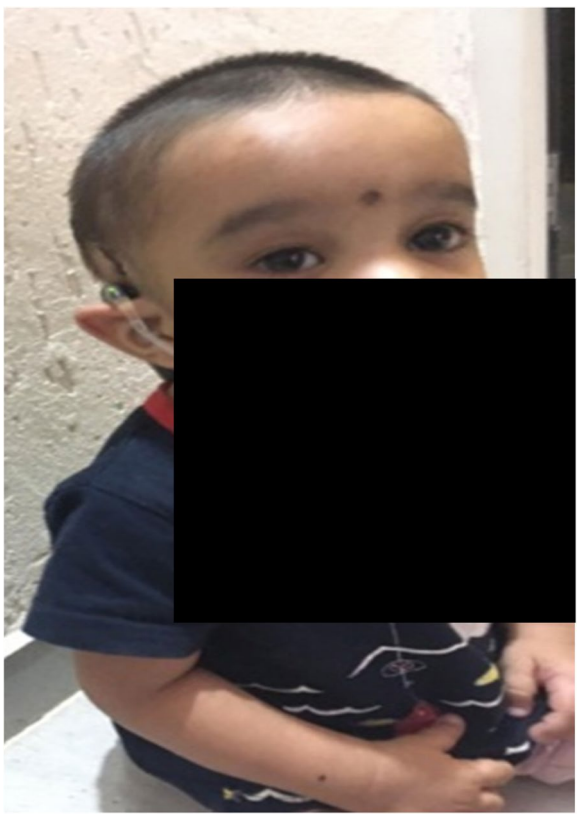

Fig. 3 Child with behind the ear processor undergoing rehabilitation

There are screening tests to determine if the blood is clotting properly and clotting factor tests (factor assays) to diagnose the specific bleeding disorder. Various screening tests are complete blood count (CBC), activated partial thromboplastin time (APTT) test, prothrombin time (PT) test, and fibrinogen test. CBC is a common test used to measure the amount of hemoglobin, the size and number of red blood cells, and the amounts of different types of white blood cells and platelets. Typically, the CBC results are normal in hemophilia patients; however, the hemoglobin and red blood cell count might be low due to unusually heavy or prolonged bleeding [10]. APTT tests measure clotting time, primarily based on the clotting abilities of FVIII, FIX, FXI, and FXII. Normal times are 25–35 s, while deficiency of FIX prolongs clotting by up to 2.5 times. PT tests measure clotting time, primarily based on the clotting abilities of fibrinogen, prothrombin, FV, FVII, and FX. Results for hemophilia B patients were not affected in our case. BT, CT, and PT were normal. Moreover, now APTT screening test is mandatory in our center in CI surgeries.

Prophylaxis protocol at our center in hemophilic patients undergoing cochlear implant surgery

Give an initial dose of factor IX of 100 to 120 units/kg to raise the factor IX level to 100 percent. This calculation assumes a starting factor IX activity level close to 0%, and a desired factor activity level of 100%, and a volume of distribution of approximately 1 dl/kg.

The dose equals the patient's weight (in kg) multiplied by the desired rise in factor IX level (as a whole number, such that a desired factor level of 100% is entered as 100) multiplied by a factor that corrects for the volume of distribution (for factor IX, this equals approximately 1). As an example, for a 6-kg child who requires an increase to 100%, the dose would be 6kg $\times$ 100 $\times$ 1 = 600 units of factor IX. The second and subsequent doses are given at intervals of approximately one half-life of the infused product for that patient, which is based on peak levels. A typical half-life for standard half-life factor IX products is approximately 18 to 24 h. Approximate half-lives for longer-lasting factor IX products range from 54 to 104 h. These doses will be approximately half the initial dose, and will be guided by the patient's measured factor level and the desired peak level.

Give the initial factor IX bolus followed by a continuous infusion Dose of approximately 6 units/kg/hour during surgery. This method offers the advantage of consistent

levels, less frequent monitoring, and decreased factor utilization. Factor activity levels should be checked periodically during continuous infusion, with the interval determined by the previous level, dose adjustments, and clinical bleeding. Continuous infusions should not have an attached filter and the factor product should only be mixed with normal saline.

However, in this case, due to the age of the child, it was not diagnosed earlier, but with early intervention, we were able to save the child.

Conclusion

Following are the principles to be followed in cases of hemophilia with cochlear implants.

- Discussion with family to ensure that best practices are followed.
- Team approach: cochlear implant surgeon, hematologist along with experts from hemophilia center and anesthetist required for team approach.
- Cochlear implant center should have an access to lab monitoring of the factor activity levels and availability of the factor IX.
- According to the world federation of hemophilia guidelines desired preoperative level for cochlear implant surgery is 80–100% of hemophilia A and 60–80% of hemophilia B.
- Needs long stay in hospital (10–14 days).

Acknowledgements
Not applicable.

Authors' contributions
CY analyzed and interpreted the patient data regarding the bleeding disorder. DS made arrangements for the availability of blood and factor replacement products. NS and MJ performed the re-exploration surgery and was the major contributor in writing the manuscript. All authors read and approved the final manuscript.

Funding
Not applicable.

Availability of data and materials
Not applicable.

Declarations

Ethics approval and consent to participate
Ethics approval was given by institutional ethical committee (IEC), GMERS medical college, Gandhinagar ethical committee.

Consent for publication
Written informed consent was obtained from the patient's guardian for publication of this case report and accompanying images.

Competing interests
The authors declare that they have no competing interests.

Author details
[1]Department of ENT, GMERS Medical College, Gandhinagar, Gujarat, India. [2]Bombay Hospital Medical & Research Centre, Mumbai, India.

Received: 5 January 2022 Accepted: 23 June 2022
Published online: 15 July 2022

References

1. Cancio MI, Reiss UM, Nathwani AC, Davidoff AM, Gray JT (2013) Developments in the treatment of hemophilia B: focus on emerging gene therapy. Appl Clin Genet 6:91–101
2. Franchini M (2014) Current management of hemophilia B: recommendations, complications and emerging issues. Expert Rev Hematol 7(5):573–581
3. Mannucci PM, Tuddenham EG (2001) The hemophilias-from royal genes to gene therapy. N Engl J Med 344(23):1773–1779
4. Dolan G, Benson G, Duffy A, Hermans C, Jiménez-Yuste V et al (2018) Haemophilia B: Where are we now and what does the future hold? Blood Rev 32(1):52–60
5. Biggs R, Douglas A, Macfarlane RG, Dacie JV, Pitney WR, Merskey C et al (1952) Christmas disease; a condition previously mistaken for hemophilia. Brit MJ 2:1378–1382
6. Srivastava A, Brewer AK, Mauser-Bunschoten EP, Key NS, Kitchen S, Llinas A et al (2013) Guidelines for the management of hemophilia. Haemophilia 19:e1–47
7. Goodeve AC (2015) Hemophilia B: molecular pathogenesis and mutation analysis. J Thromb Haemost 13(7):1184–1195
8. Melchiorre D, Linari S, Manetti M, Romano E, Sofi F, Matucci-Cerinic M et al (2016) Clinical, instrumental, serological and histological findings suggest that hemophilia B may be less severe than hemophilia A. Haematologica 101(2):219
9. Pollmann H, Richter H, Ringkamp H, Jürgens H (1999) When are children diagnosed as having severe haemophilia and when do they start to bleed? A 10-year single-centre PUP study. Eur J Pediatr 158(3):S166–S170
10. Horava SD, Peppas NA (2017) Recent advances in hemophilia B therapy. Drug Deliv Transl Res 7(3):359–371

Publisher's Note