Childs Nerv Syst (2007) 23:601–610
DOI 10.1007/s00381-007-0312-y

COVER PICTURE

Holoprosencephaly in Mexico: first reported autopsy case by Dr. Agustín Arellano

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Published online: 20 April 2007

Abstract
Introduction Holoprosencephaly with cyclocephaly is an early disturbance of organogenesis and has been classified as a severe brain malformation starting in 1755 by Eller in Germany, then in 1822 by Etienne Geoffroy de Saint-Hilaire in France, and finally in 1828 by Tiedemann in Germany. In 1839, Dr. Arellano published in Mexico a necropsy case of holoprosencephaly. This was the fourth publication worldwide on this kind of pathological alteration. Furthermore, in reference to diaphragmatic herniation, Arellano's paper is the fourth world report, having appeared 9 years before Bochdalek's publication. We have not found any other report that appeared before 1839 in the Americas on this particular malformation, and we consider that Arellano's paper was the first of its kind on the American continent.
Conclusion As is well known, the publications of this Mexican medical researcher were, for his time, at the level of those of the most developed countries. It is also important to know that the medical journal where Arellano's work was published, the "Periódico de la Academia de Medicina de Mégico(sic)," founded and directed by Dr. Manuel Carpio in 1836, is the direct forerunner of the present Gaceta Médica de México, the oldest currently published journal in the Americas.

Keywords Holoprosencephaly · Diaphragmatic hernia · History of medicine

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Introduction

The complete or partial absence of diverticulation of the prosencephalus has generally been called prosencephaly (HL). This is a malformation produced in the embryonic period, in the course of organogenesis, between the fourth and the eighth week of gestation. The seriousness of the problem varies from a defect, which is at times hardly evident, as in septo-optic dysplasia or in DeMorsier's disease, to severe malformations incompatible with life. Cyclocephaly represents the gravest type of holoprosencephaly, and it is characterized, in addition to the well-known cerebral malformation, by a typical facial malformation, with a single eye housed in a single orbit, giving the name to this variety of HL. The engraving on the cover shows a typical case of cyclocephaly [6, 7, 23, 26].

HL may be present by itself or combined with some other malformations, and its origin is polygenic and multifactorial. Hydrocephalus may become associated in 40 to 80% of HL cases [24, 26].

In Mexico, Dr. Agustín Arellano was the forerunner in the description of these embryological alterations in 1839. To the best of our knowledge, there is no other related reference in the literature in the Americas, and the publication reviewed here is the fourth worldwide. Therefore, we might venture to say that, unless proven otherwise, this reference is the first description of these two malformations on the American continent [1, 23, 26, 29].

Cyclocephaly: a historical background

In the Western world, the first references to the cyclopes are found in Hesiod's *Theogony* and Homer's *Odyssey* [17, 18].

In the first work, the cyclopes were three giants who belonged to the first generation of gods. They were named Brontis, Estheropis, and Piracmon, children of Uranus and Gea and born a generation before Zeus. When the well-known confrontation between Uranus and one of his sons, Chronos, broke out, the latter not only defeated his father but also castrated him. Chronos then incarcerated the cyclopes in Hades with the aid of the Titans. These cyclopes from the so-called Uranic generation were uncles of Zeus. They helped him take power and, as foundry experts, created the thunderbolt, which the god used as an instrument to enforce his might.

In addition to their collaboration with a divine being and their metallurgic skills, these personages were not held in high esteem from those who dared meet with them. According to several accounts, they were nothing else but ruffians whose strength and knowledge of the blacksmith's craft helped support one warring faction of gods. They killed Asclepius, a physician and Apollo's son, at the request of Zeus himself, under the pretense that he cured too many sick people [12].

In reference to the so-called Homeric generation, in the ninth book of the *Odyssey*, Homer tells us about the meeting of Ulysses and Polyphemus. The latter was considered by these beings as the epitome of the cyclopes, whose reputation had been waxing, although he still did not quite stand for the summit of their aspirations. He was a shepherd who knew about cereals and the process of turning them to bread, as well as grape growing and wine making. This Cyclops claimed a close kinship with Zeus. He was, in fact, his nephew by Poseidon, Zeus' brother, and a mortal woman. Thus, Polyphemus was only a semi-god, in contrast to the Uranic cyclopes who were true gods.

This Homeric Cyclops had already gained the ability to reason like humans, although he made his decisions solely in regard to his purposes. This fact does not make him any better or more human, rather, his attitudes were still primitive. To top it all, he was a cannibal.

The behavior of Polyphemus toward Ulysses and his comrades was base. He killed and devoured two of them and even threatened Ulysses with killing him and gulping him down. Nevertheless, and thanks to some sort of Polyphemic compassion, such deed would be deferred to the very last instance, only after Polyphemus had been done with the whole crew of the fleet of ten ships. This design was frustrated thanks to Ulysses' wise plan of first inebriating the Cyclops and then blinding him with the monster's own cane, which he had previously heated and plunged into the Cyclops' eye. It was not an easy task for the Greek warrior to get rid of the monster: He had to resort to his proverbial deftness so as not to fall prey of the gluttonous Polyphemus and end up in his stomach [18].

Although Euripides' Cyclops is less primitive, he still showed a great deal of turpitude. In addition to sharing the aforementioned features, this Cyclops was paraphilic, which makes him even more despicable.

As may be noted, cyclopes were far from being la crème de la crème of ancient Greek society for they were neither divine nor human, remaining stranded between the two genera [21].

In book IV, chapter 32 of his *History*, Herodotus mentions cyclopes. With his usual historical–scientific approach, thus the author places in the mouth of the Scythians a statement confirming the existence of the cyclopes: "[...] for [...] the Scythians [...] speak about the one-eyed beings [...]" [16].

In his *Geography*, Strabon, the outstanding geographer at the time of Augustus, refers to cyclopes. His respect for Homer prevents him from denying their existence, although he does not avail it either [8].

Gaius Plinius Secundus, the elder, offers interesting accounts about cyclopes, the regions they inhabited, their habits, and everything else of matter regarding them. Francisco Hernández, "*protomédico*" to Philip II of Spain, produced an annotated translation of Plinius' *History*. In this work, in book VI, chapter XXX, he mentions, first: "[...] the negroes maintain their king has a single eye in the middle of his forehead [...]," and in book VII, chapter II, he clearly states: "[...] there have been in Sicily and Italy [...] people [...] called cyclopes [...]." Furthermore, in Gesglition, it is asserted: "there are [...] the Arismaspi of whom people said were beings bearing a single eye [...]" [15].

Cyclopes are also mentioned by Isidoro of Seville, who limits himself to repeating what the Ancients had already written [19].

Accounts stemming from the Middle Ages refer at times to these freaks, and they were abundantly classified and reproduced with the advent of the press. In those times, people still believed it was possible to find cyclopes in unexploited regions of the planet. Every so often, the birth of occasional cyclopes has helped to feed such expectations.

Only after the Enlightenment was the existence of cyclopes finally approached with a scientific spirit. In 1755, in Berlin, Eller reported in a medical journal for the very first time the case of a cyclops. In his turn, in 1822, Etienne Geoffroy de Saint-Hilaire described another case, and Tiedemann published four cases of HL in 1824, two of which were cyclopes. The accompanying description of the cerebral abnormality is available for all of these six cases [23, 26].

Cyclopes in Mexico

Without a doubt, the presence of cyclopes had been generally acknowledged by Renaissance culture, a culture that reached the Mexican nation and people during the sixteenth century. As we have commented, cyclopes and their habits were documented in the Natural History of Gaius Plinius Secundus. In Mexico, Dr. Francisco Hernández argued, with good notion, that reports of these human types had reached Mexico City as early as the sixteenth century.

We may also be certain that such reports were reviewed by intellectuals of the caliber of Alonso de la Veracruz, Juan de Zumárraga, or Francisco Cervantes de Salazar, among others, given their widely known cultural background and their influence on society.

Reference to human and animal cyclopes in scientific publications in Mexico: 1785, 1839, and 1870

The first reproduction of a case of cyclocephaly in Mexico is found in the pages of a medical book, which may also well be the first illustration depicting this condition on the whole American continent, printed in this country. This book was published in 1785 by Juan Nepomuceno López de Miranda, 30 years after the one written by Eller. It was printed in the press of Felipe de Zúñiga y Ontiveros and is entitled: *Papel para corregir la desrreglada método* (sic) *con que se socorren los picados de alacranes y prevenir los auxilios que necesita tan grave mal en la Ciudad de Durango, siendo médico del Real Hospital de esta ciudad* [13, 22] (Fig. 1).

The image of a cyclops appears on page 115 of this book. It is a fine woodcut, representing an edocephalic cyclops. On one side, there are some facts in reference to the circumstances of his birth, such as the date 12 March 1785, the name of the estate in Aguascalientes where he was born, the name of the owner of the property, and even with utter indiscretion, the surname of the cyclops' parents. It is also stated there that he died shortly after birth: "... after receiving the baptismal waters..." (see the cover engraving and Fig. 2).

In the event, the case we are mainly concerned with here is the publication, in 1836, of a human cyclops born in Mexico City. The account was reported by Dr. Agustín Arellano, a brief 15 years after Tiedemann's publication. A detailed description of the brain necropsy, which will be provided later, also mentions a right diaphragmatic hernia and may be considered the fourth known report on this problem on the Western hemisphere [1].

In his volume, dedicated to the nineteenth century of *Historia de la Ciencia en México*, Elías Trabulse reproduces an interesting article on the birth of a porcine cyclops. This article was originally written in 1870 by Juan M. Rodríguez for *La Naturaleza, Periódico Científico de la Sociedad Mexicana de Historia Natural*. It was printed in Ignacio Escalante's press, 95 years after the first reference to a cyclocephaly appeared, specifically, that by Nepomuceno López, and 31 years after Dr. Arellano carried out the autopsy of a cyclops. As may be observed, holoprosencephalic scientific literature in Mexico rambled at an easy pace, for there was a near 30-year span between one publication and the next [27, 30].

In addition to a lithography showing the freak's head with absolute clarity, Dr. Rodríguez provides an erudite

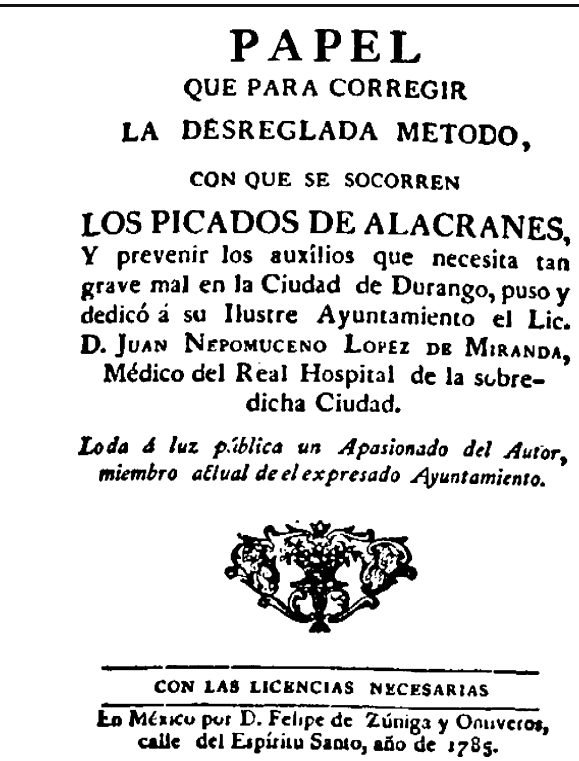

PAPEL
QUE PARA CORREGIR
LA DESREGLADA METODO,
CON QUE SE SOCORREN
LOS PICADOS DE ALACRANES,
Y prevenir los auxilios que necesita tan grave mal en la Ciudad de Durango, puso y dedicó á su Ilustre Ayuntamiento el Lic. D. Juan Nepomuceno Lopez de Miranda, Médico del Real Hospital de la sobredicha Ciudad.
Loda á luz pública un Apasionado del Autor, miembro actual de el expresado Ayuntamiento.
CON LAS LICENCIAS NECESARIAS
En México por D. Felipe de Zúniga y Ontiveros, calle del Espíritu Santo, año de 1785.

Fig. 1 A 1785 book by Dr. Juan Nepomuceno López de Miranda in which the facial image of a Cyclops, a severe case of holoprosencephaly, was published for the first time in Mexico, and quite possibly in the Americas, in a medical text

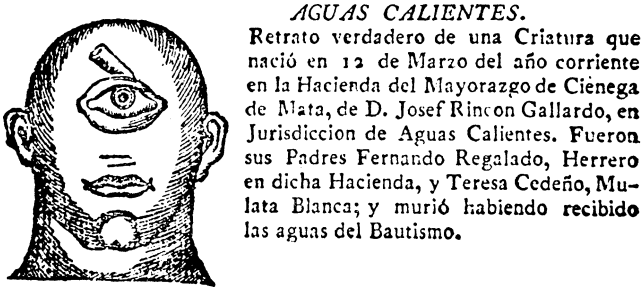

AGUAS CALIENTES.
Retrato verdadero de una Criatura que nació en 12 de Marzo del año corriente en la Hacienda del Mayorazgo de Ciénega de Mata, de D. Josef Rincon Gallardo, en Jurisdiccion de Aguas Calientes. Fueron sus Padres Fernando Regalado, Herrero en dicha Hacienda, y Teresa Cedeño, Mulata Blanca; y murió habiendo recibido las aguas del Bautismo.

Fig. 2 Figure of a Cyclops published in Juan Nepomuceno López de Miranda's book. This is undoubtedly one of the most severe cases of holoprosencephaly in record, having a hedocephalic appendix above a single orbit and eye

appraisal of the history of this malformation in medicine, mentioning, among others, the forefathers of research on this teratological defect: Morgagni, Tiedemann, Meckel, Liceto, Peyer, Geoffroy de Saint-Hilaire, Eller, and Roll.

On deciding to directly donate the specimen to the museum of the School of Medicine of the University of Mexico, Dr. Rodríguez did not practice necropsy; instead, he presents a detailed description of the external features of cyclocephaly. From this stand, this physician provides an adequate classification of the malformation including: first, hypotelorism, then, a single socket housing two eyes, third, a single socket with two incompletely fused eyes and, finally, a single eye occupying a single socket. Based on the descriptions of the aforementioned authors, Dr. Rodríguez gives a precise account of the cerebral features of cyclocephaly.

However, this author does not mention the classification on 1836 of Etienne Geoffroy de Saint-Hilaire, that on 1882 of Kundrat having not yet been published. There also are two descriptions conceived according to the external features of the malformation.

The woodcut illustrating the text is a very fine piece of work (Fig. 3). It shows a typical edocephalic cyclops whose appearance, with the exception of the ears, might pass for human. In addition to these publications, which refer only to HL, curiosity about central nervous system teratology originated some other works, such as the one carried out in 1870 by Juan María de Rodríguez about an anencephalic monster, born in 1866 in Mexico City, with a cranio-rrhachischisis [28] (Figs. 4 and 5). Rodríguez was the most knowledgeable and interesting teratologist of ninteenth century Mexico, and he therefore deserves the publication of a critical biography in which his pursuits and contributions may be properly evaluated.

The Arellano case report: necropsy of a cyclops with a diaphragmatic hernia and bicorn uterus, published in 1839 in Mexico

El Mercurio Volante, published in Mexico City, was the first medical journal on the entire American continent. It was edited, from 1772 to 1773, by Dr. José Ignacio Bartolache and printed by Felipe de Zúñiga y Ontiveros. Those occupied with these concerns in Mexico after the time of the latter two medical men were on a par with them. *The Periódico de la Academia de Medicina de Mégico* (sic), published from 1836 to 1841, printed papers from physicians trying to share their scientific findings and historical vicissitudes in medical practice with others. Dr. Manuel Carpio was its founding director. The *Periódico* was written without interruption and directly preceded the oldest circulating medical journal in the Americas, the *Gaceta Médica de México* [10, 11, 14, 20].

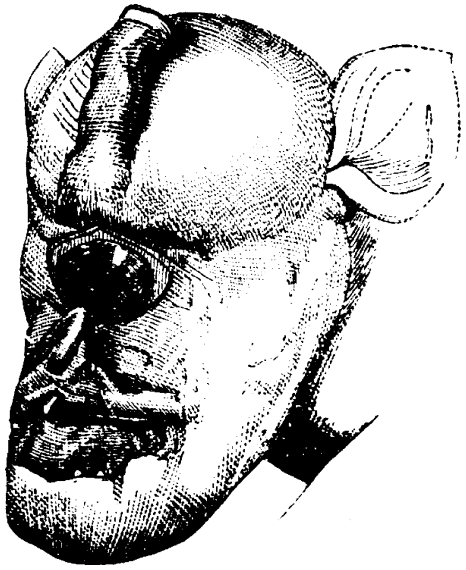


Fig. 3 The head of a holoprosencephalic pig. Case reported in 1870 by Dr. Juan M. Rodríguez in *La Naturaleza, Periódico Científico de la Sociedad Mexicana de Historia Natural*. It was printed in Ignacio Escalante's press, 85 years after our first reference to a cyclocephaly, as reported by Nepomuceno López, and 31 years after the autopsy of a Cyclops, carried out by Dr. Arellano

On reviewing the interesting and complete *Bibliografía General de la Academia de Medicina*, 1836–1956, by Dr. Francisco Fernández del Castillo, we were pleasantly surprised on finding Dr. Arellano's article in volume 4 of the *Periódico*, corresponding to 1839, where he reported the birth of a dead fetus and the complete necropsy of a girl born with "rhinencephaly" and a massive diaphragmatic hernia [1, 10] (Fig. 6).

We could establish that the necropsy was well detailed, and that it included a careful description of facial, cerebral, and thoraco-abdominal malformations. This fact allowed the reconstruction of the appearance of the encephalon under description, corresponding to one of the most severe forms in the spectrum of HL. The report ends with a lithography showing the cyclops, her diaphragmatic hernia, and a bicorn uterus.

In those times, illustrations from medical journal consisted mostly of lithographic reproductions. The lithographic technique was introduced in Mexico in 1826 by Claudio Linatti, an Italian artist [9]. Arellano's lithography, based on a drawing by Tomás Coto, a medical student, and engraved by an anonymous artist, is a delicate piece of work showing the thoracic and abdominal cavities, the bicorn uterus, and the cyclops' face. Unfortunately, it does not show the open cranial cavity of the brain. Still, the plate suffices to inform us, leaving no place for doubt, of a case of cyclocephaly, with an intermediate supraorbitary proboscis. The single-eyed globe has two pupils housed in a single socket. The figure accompanying the paper, and

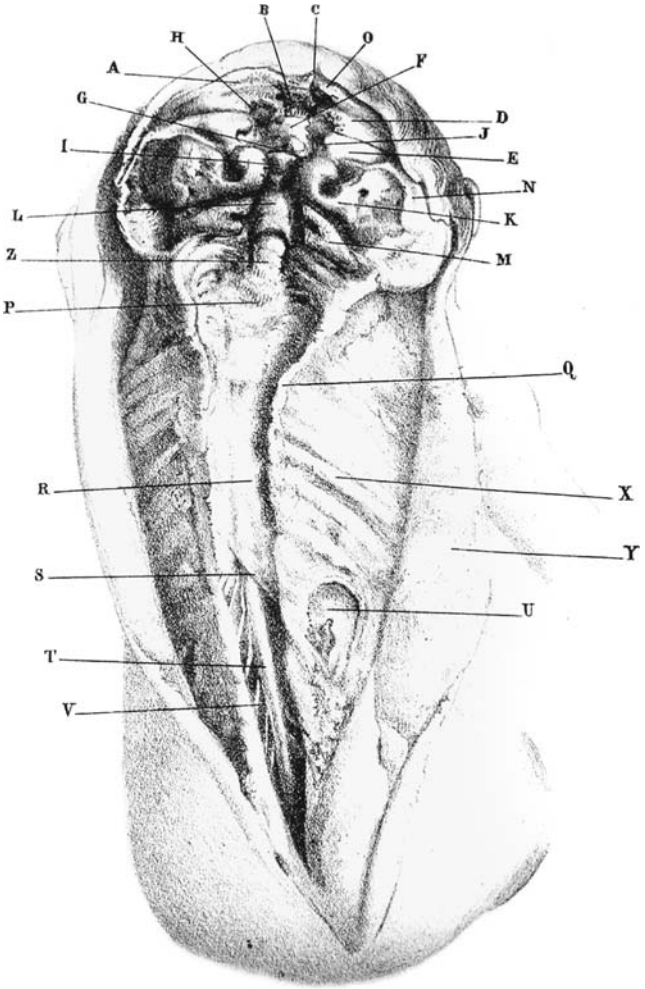


Fig. 4 Image of a craniorrhachischisis. This case was studied and published in 1870 by Juan María Rodríguez in *El Porvenir*. It bears the title *Description of a derencephalic monster born in Mexico in December, 1866*

reproduced in this study, will more than serve the purpose of illustrating the malformation (Fig. 7).

The author opens his article telling us that, on December 14, 1839, he was called to see a lady who the previous day had given birth to a monstrous dead girl, which caused some uproar among neighbors. Dr. Arellano was able to calm things down, took the corpse with him and practiced its autopsy. Given its clarity, we will transcribe the description here as it also reports of a massive right diaphragmatic hernia and a bicorn uterus (Figs. 8 and 9).

Cranial-cerebral autopsy

...Head.

[The head was] of regular size. From its external part, a cylindrical tegumentary appendix, about an inch long, protruded. It was located on the middle lower part of the coronary bone, with a conduct on its free extremity which prolonged itself to the surface of this bone; the inner part of this conduct was lined in such a way as to resemble mucus.

On the lower part and at a close distance from this tegumentary appendix, the socket containing the ocular globe, around which lay the eyelids, and divided into four obtuse angles, upper, lower, and two lateral ones, could be seen. There were small eyelashes on the edge of the eyelids. The eye had two pupils, with quite a hardy membrane between them, whose surface resembled that of a parallelogram; the conjunctiva was well developed, and one appeared to note two transparent corneas. There was no nose. The condition of the remainder of the face was normal.

Once the skin was peeled off, one could observe the coronal, parietal and occipital bones knit together without forming what is known as fontanels.

In order to disarticulate the parietals, it became necessary to break down the dura mater, not only at parts which seemed normal but also where there were adherences to those bones.

After being uncovered, the brain showed a deep red shade and incomplete development. Its shape was very similar to that of a horseshoe whose ends rested on the cerebellum and its body on the arch inside the coronal cavity. Although no lobules or circumvolutions could be discerned in the brain, a corpus callosum (CC) was noticeable at first glance in the space between the ends.

The [basal?] or occipital bone was irregularly shaped, and could be compared in shape to a common shell. The cavity of the bone contained the cerebellum, whose volume struck us as double than normal in proportion. It was covered on top by a segment of dura mater.

The extreme softness of the cerebral pulp did not allow one to follow the direction of the nerves: that of the optical nerves could be ascertained, with great effort, from its source on each side of the arch of the horseshoe, as we have mentioned, by the presence of two divergent fascicles which, having each penetrated the optical holes, joined in a single fascicle at the back of the eye.

Once rid of this, one could notice the socket was formed on top by the coronal bone, which had, on its internal surface, two cavitations corresponding to sockets, i.e., two optical holes from which the corresponding nerves emerged. The holes were located on the lateral and lower parts of what is known as the sella turcica.

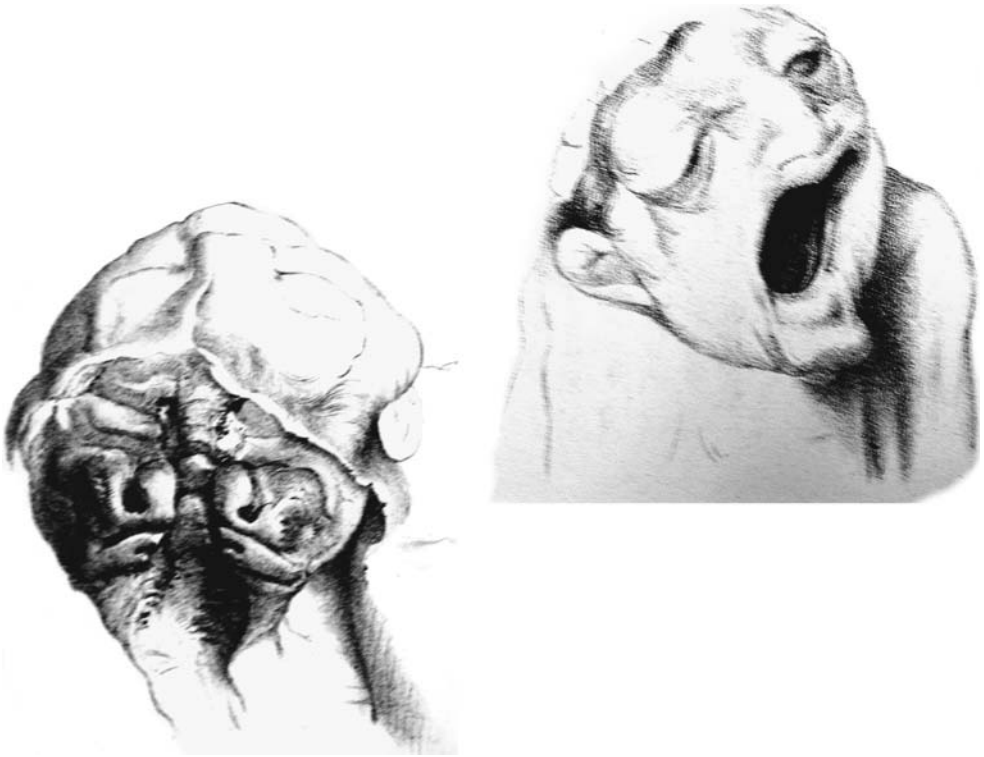


Fig. 5 The head of a craniorrhachischisis published in 1870 by Rodríguez in *EL Porvenir*. There, it is possible to distinguish the typical facies of this type of malformation

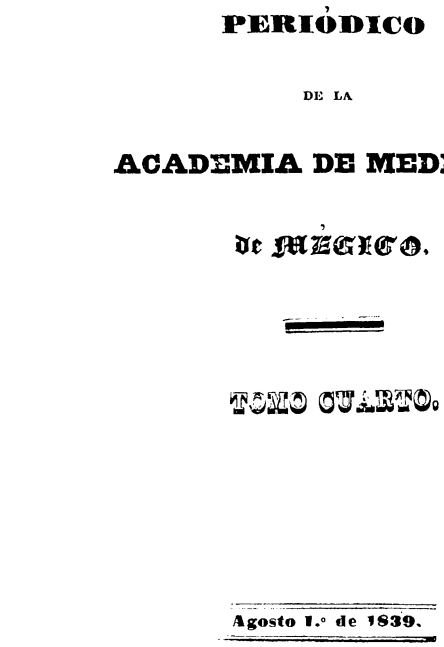
> The place of the ethmoid bones was occupied by a tiny body reminding one of a fibro-cartilaginous membrane that communicated with the tegumentary appendix. It was about two lines long and one in width and breadth.
>
> Both maxillary bones formed the lower part of the socket, and were exactly joined at their internal and upper edge.
>
> There were no montant apophysis, vomer bone, turbinal bones or unguis, as were also lacking the bones of the nose; the top of the socket was formed only by the coronal and sphenoid bones. We noted two lachrymal glands, two oblique external muscles, two right upper and two lower branches.
>
> Once the internal cavity of the eye had been opened, one noted two semi-spherical halves, separated by a cloison formed by a fibrous membrane, leaving no doubt the eyes had gathered to form a single globe. One noticed two choroids, two pupillae, two irises, two small spherical bodies, considered to be the crystalline bodies. The optical nerves were joined in one, and it was not possible to see whether there were two retinas...

A commentary on the autopsy of the brain

This accurate description of one of the most severe cases of HL described has kindled our attention, especially because it goes back to such early times as 1839. It is worth remembering that, in 1775, Eller provided the first description of a necropsy. In 1822, Etienne Geoffroy de Saint-Hilaire published another case that also included an autopsy. Tiedemann's related cases were published in 1824. Dr. Arellano's publication appeared a brief 15 years later.

Dr. Arellano's description refers to an alobar type of HL with a dorsal sac, according to DeMyer and Zeman, or to a type "A" HL with a dorsal sac, according to Probst's. He finds a scarce amount of brain matter adhering to the frontal (coronal) bone. This author masterfully described the horseshoe-like hippocampus (HP), so typical of this type of HL, indicating how the external extremities of the horseshoe rest on the cerebellum. At the back of the eye globe, there is a single optical nerve, split in two, coursing through two optical holes and reaching the holoprosencephalic brain. The morphology of this most severely deformed holoprosencephalic brain is well described. He is impressed by the large size of the cerebellum, compared to the scarcity of cerebral matter.

The only remarkable aspect worth mentioning of such a correct description is the fact that Dr. Arellano found a CC, something completely unthinkable in such a malformation. This observation could perhaps be traceable to a thick HP, appearing as an abnormal CC. Otherwise, he does not mention the presence of arrhinencephaly, so typical of this problem, although the title of his work clearly states it.


PERIÓDICO

DE LA

ACADEMIA DE MEDICINA

DE MÉGICO.

TOMO CUARTO.

Agosto 1.° de 1839.

MÉGICO.

Imprenta de Galvan a cargo de Mariano Arevalo
Calle de Cadena núm. 2.

Fig. 6 Volume four of the *Periódico de la Academia de Medicina de Mégico* [sic], from 1836. In this issue, Dr. Agustín Arellano published his case of the autopsy of a Cyclops with a diaphragmatic hernia

He notices, quite rightly, the lack of bones in the midst of the facial massif, which is also one of the features of this type of HL.

The author also accurately describes the big diaphragmatic hernia and the bicorn uterus.

Current classifications of holoprosencephaly

Current classifications of the malformation under discussion are grouped according to cerebral alterations. In this study, the two classifications considered most comprehensive will be analyzed. Probst's classification was conceived in relation to pathological features, whereas that of DeMyer and Zeman is related to image findings. The latter is better known and more commonly used although it is not as fine or specific as Probst's [6, 7, 26].

These two classifications include concepts from old classifications in reference to facial appearance.

(a) Probst's or pathological classification:

1. With a dorsal sac

– Types A, B, and C

This group includes the most severe forms in the spectrum, for example, the one accompanying cyclocephaly type A, to types of intermediate severity, such as B and C, and is always characterized by presenting a membranous dorsal sac, adhered to the undivided HP.

Fig. 7 A very clear representation of a Cyclops. In this figure, two fused ocular globes present two pupils within a single orbital fossa. The eyelids have four commissures: two lateral ones, one on the upper side, and the remaining one on the lower side. There are also two shadows that may have accounted for the eyebrows. In any event, there is a single edocephalic appendix

These subtypes always feature undivided thalami, located in a more frontal position than in normal subjects. There is a single pyramidal cortex, the same applying to the rest of cortical neuron types. A horseshoe-shaped HP is present in the most severe expressions of the malformation. In these most severe forms, the vessels adopt a fan-like morphology in their cerebral portions, accompanying the holosphere. In less severe forms, there is a frontal cerebral azygos artery and several types of abnormalities of the middle cerebral arteries. These blood vessels course along the internal wall of the cranium.

The CC is missing in all three types; the same happens with the rest of the commissures.

Concerning the face, this subclassification includes cyclopes, ethmocephalus, cebocephalus, and unilateral or bilateral labial-palatal clefts.

2. Intermediate

– Types A, B, and C

The pathological features are those of a primitive brain, lacking the first cranial pair and the interhemispheric fissure, with a holoventricle and no commissures. The appearance of the thalamic nuclei is similar to the one described in the dorsal sac variety. Although the presence of a horseshoe-shaped HP is inferred as well, this has not been described.

A noteworthy variation in relation to the preceding type of HL is that facial abnormalities are discreet: hypotelorism,

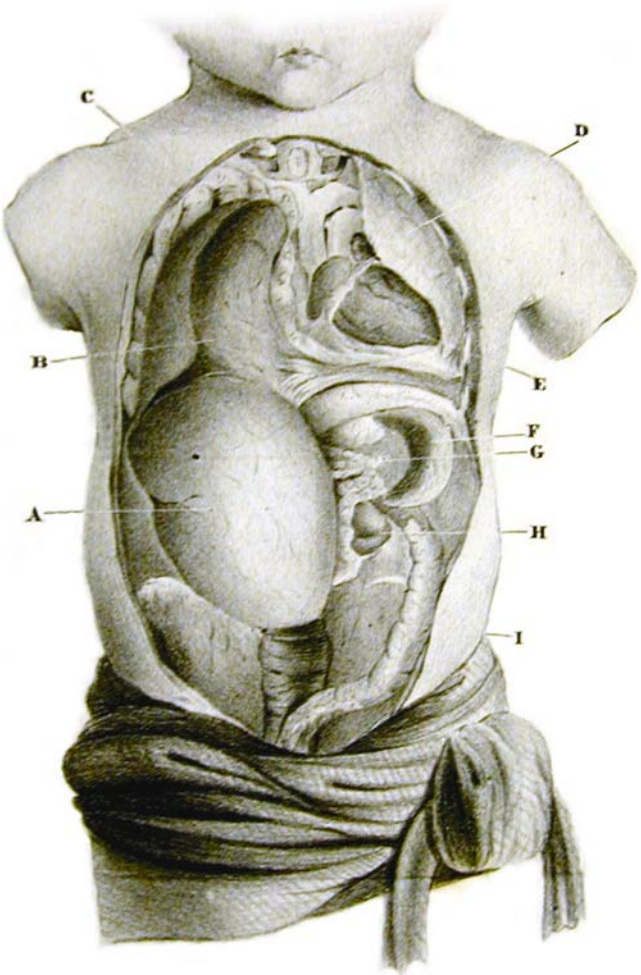


Fig. 8 In addition to the accurate written description of a diaphragmatic hernia, we have this precise and beautiful lithography. It shows, with absolute clarity, how the abdominal contents are herniated toward the right thoracic cavity

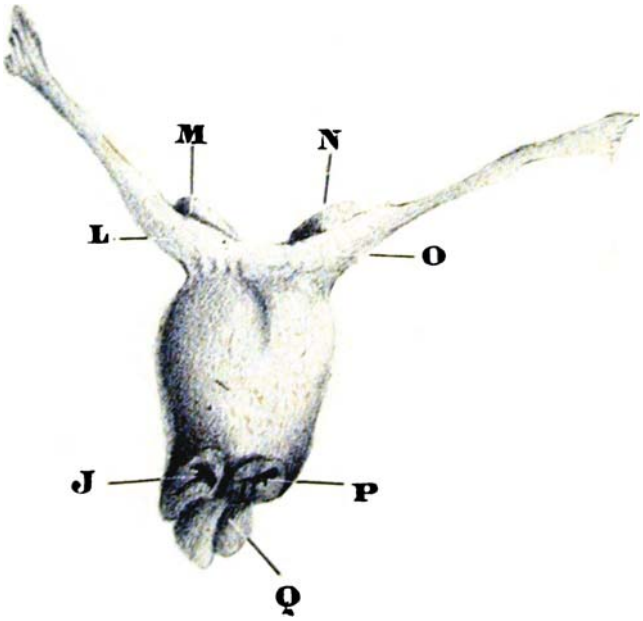


Fig. 9 In the same necropsy, there was another malformation, a bicorn uterus

mild at times, a single upper incisor and, in some cases, lack of facial alterations.

3. Pseudo-hemispheric

This condition is one of the less severe forms in the spectrum. There seems to be a complete division of the hemispheres and diencephalic structures, which may be partially fused, to a more or less considerable degree, and which almost occupy their normal place inside the brain.

In this case, as with the rest of HL, the CC is missing, and the cerebral cortex links the two hemispheres through the cingulate gyri, replacing the CC.

4. Partial

Main characteristics are: absence of the first cranial nerves, various degrees of commissural dysplasias, and bridges of grey matter at a cingulate level.

(b) DeMyer and Zeman's or imaging classification

1. Alobar

– The face

Cyclopy, anencephaly, cebocephaly, and upper median labial cleft, corresponding to a microcephalic cranium, in the first three types; trigonocephaly sometimes accompanied by a labial cleft, in the latter type. In cyclopes, a single eye socket is present; the rest of the face shows a more or less appreciable hypotelorism.

– The brain

There is a single ventricle. The brain is undivided, with a single horseshoe-shaped HP. In these cases, a dorsal sac adheres to the HPS. Pyramidal areas form a single structure as well. The thalami are undivided and located at the front of the cranium. The first cranial nerves are absent, and there are no commissures.

2. Semilobar

– The face

There are not enough cases to establish a pattern. The cranium is generally microcephalic. Different degrees of hypotelorism are manifested.

– The brain

It is small with an onset of a diverticulation and presence of primordia of the hemispheres and the interhemispheric sulcus. A cerebral cortex joins the two primordial of the hemispheres. There is an absence of the first cranial nerves; at time, a sketch of the CC is observed, as well as a dorsal sac adhered to a

single HP, although, in some cases, this sac can be partially separated, in general, the first cranial part is missing.

3. Lobar

– The face

It is formed by a philtrum and a hypoplastic premaxilla. The cranium is generally microcephalic, with trigonocephalia and different degrees of hypotelorism.

– The brain

It already has two "hemispheres," resembling a more or less complete diverticulation. Two different types of brains are reported: type "A," with a cerebral cortex fusion towards the frontal region, and type "B," in which no fusion has been reported.

There is presence of a holoventricle. Thalamic fusion in a frontal position is characteristic of this variety. At times, there is absence of the first cranial pair.

4. Lobar

– The face

With or without any evident facial malformation. Trigonocephaly or hypotelorism may be present.

– The brain

The lobes are well formed, normal in size, with an interhemispheric fissure, which is sometimes interrupted by cingulated or frontal cortical bridges. The first cranial nerves may be missing, and the CC is generally absent; this may be hypoplastic or normal.

Conclusion

Generally, teratology was born having in mind some of the main cosmogonic myths of humankind. We have talked about what cyclopes meant to ancient Greeks. Still, we did not mention, in this regard, the relevance of the astounding Nahuatl pantheon, which included a variety of deformed beings. These went from the foot in Tezcatlipoca's mirror to the impressive head of Coatlicue at the National Museum of Anthropology in Mexico City, which is made up of two streams of blood spurting forth in the form of a two-headed serpent. Something similar may be concluded in reference to the abundant Mayan hieroglyphs related to these occurrences.

In its turn, the rich Hindu religion includes elephant-headed gods and many-armed beings. Ancient Egyptian mythology also had many divinities that were a mixture of humans and animals: ibis, jackal, or ox, just to mention a few [25].

More modern teratology evolved together with the consciousness of the existence of aberrant processes produced in the course of embryonic development, processes which may have originated cyclopes, mermaids and mermen, simian faces, bird-like palmate hands and feet, and a myriad of other malformations.

Generally, the second half of the eighteenth century and the beginning of the nineteenth century had to wait for more knowledgeable descriptions of these freaks, made possible through the practice of necropsies of exemplars born in different places. This situation led the way to the true birth of contemporary teratology, incorporating sound information on and conception of malformations.

The description in 1839 of a cyclops in Mexico, with its respective necropsy, placed this country nationally and culturally among the few privileged nations applying, for the time, high academic standards to the study of these malformations and approaching them as scientifically as possible.

If we consider that the first account of HL came from Heller in 1755 and that this was followed in 1822 by Saint-Hilaire's and in 1824 by Tiedemann's, Dr. Arellano's publication in 1839 of a case of HL that included a necropsy study places this as the fourth reference of this kind in the world medical literature.

After the extraordinary level attained by Mexican medicine in the sixteenth and seventeenth centuries [2–4], one could expect that a similar later flowering seemed unlikely. However, the various outstanding medical reports stemming from the nineteenth century argue against this notion. In the course of the history of this country, one may find more than one period of scientific blooming. The history of medicine in nineteenth century Mexico reveals how, despite incongruities and inconsistencies of politics, medical practitioners and medical science produced impressive studies of different diseases [11].

In the context of the medical sciences, memories of an intelligent past, with a truly strong presence being felt at the time of its occurrence, offers a good incentive for Mexicans working in these areas to project a better medical and scientific future for themselves.

Mexican medical practitioners from the nineteenth century were on a par with the best physicians of the world. Suffice in this regard to remember the endeavors of Dr. Rafael Lavista, one of the precursors of brain surgery worldwide, in Mexico City in 1892 [5]. Similarly, Dr. Arellano and Dr. Rodríguez, as Mexicans, occupy outstanding positions in the history of international teratological studies.

We owe to the medical men our current medical present. This article is rightly dedicated to them.

Acknowledgement This paper is dedicated to Professor Patrick Dhellemmes.

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