

On Alexander's pneumothorax: A critical appraisal

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Abstract

According to the testimony of Ptolemy, which we know through Arrian, it has been assumed that Alexander the Great suffered a pneumothorax during his campaign against the Malli. In general, this assumption has been interpreted as a historical fact in medical literature. We consulted the same sources and concluded that it is unlikely that Alexander's arrow wound had given him a pneumothorax. In addition, we stressed the extra-historical content of classical sources. (Gac Med Mex. 2016;152:754-60)

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One series of words is Alexander and other is Attila Borges¹

In Châtillon's *Alexandreis* ninth book, Alexander the Great was lacerated by an arrow on the right side. Believing he was dead, the Indian archer who had wounded him quickly approached to plunder his victim. Even when he was in a languishing state, Alexander, with his sword, took the profaner's life and then exclaimed: "If Alexander is on his way to the shadows, he said, so be it, and thus announce me as my messenger"².

Châtillon's main source was Quintus Curtius, who perhaps flourished under Claudius, i.e., more than three centuries after the Macedonian's death in 323 BCE³. This episode, upon which Châtillon composed his verses, is found in the ninth book of *Historiae Alexandri Magni*: after having reached the Sudracae's city,

disregarding Demophon's omen, Alexander climbed its walls. Standing at the top, he was the target of abundant projectiles and, with the ladders having collapsed, he hastily plunged into the city. The Macedonian landed on his feet and, to avoid being surrounded, he placed himself against a tree; Sudracae proliferated endlessly (Fig. 1), but they gave up on proximity after he had slain two by the sword. They restricted then their attack to projectiles, from which the Macedonian protected himself with his shield, until an archer shot a two cubit-long (about 88 cm) arrow, which penetrated his breastplate and lodged a just above the right flank (*ut per thoracem paulum super latus dextrum infigeret*). While bleeding, Alexander dropped his weapons, and at this point occurred what Châtillon versified at the beginning: the archer tries to plunder his victim; the Macedonian's words do not appear in

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Figure 1. Alexander against the Mallians. This illustration contains all the elements of the passage in question (the wall, the tree, Alexander and his shield, the archer, etc.) and it is from an Amsterdam edition (1696) of the translation of Curtius made by Claude Favre de Vaugelas. Reproduction of this print with permission of Andrew Chugg (www.alexanderstomb.com).

Curtius, but we can guess them between the lines. Peucestes came to the rescue of the king, followed later by Timaeus, Leonatus and Aristonus. The former protected Alexander behind his shield, in spite of having sustained three arrow wounds. Timaeus succumbed during this endeavor. Words on the king's death spread among the Macedonian troops; enraged by these rumors, they perforated the wall and occupied the city, annihilating all its inhabitants. They brought the Macedonian to his tent, where the doctors had the shaft cut off to immobilize the iron. As they stripped him naked they realized that the arrow had a barbed head (*animadvertunt hamos inesse telo*)⁴, i.e., furnished with hooks⁵, and that the only way to extract it with no further tissue damage, was by broadening the wound. However, enlarging it entailed the risk of causing another hemorrhage, since it appeared that the

arrowhead had penetrated into the viscera (*et penetrasse in viscera videbatur*). Kritoboulos was the physician who extended the wound and removed the missile; after all this, Alexander bled profusely and lost consciousness. Blood flowed until self-contained, and then the Macedonian recovered consciousness. The wound, even when not healed, was cured in seven days^{3,6}.

According to Curtius, Cleitarchus and Timagenes related that Ptolemy took part in this battle; he, in turn, denies his intervention (*FGrH 138 F 26b*)⁷. The works by these authors, as well as those by other Alexander coetaneous, are only fragmentarily preserved (or preserved through allusions). Callisthenes, Aristobulus and Onesicritus are also part of Curtius sources, although they are not mentioned⁹. In addition to Curtius, other authors of Antiquity addressed this difficult moment of the Macedonian's life. Those whose works resisted the ferocious passage of time are Diodorus Siculus, Pompeius Trogus (through Justin), Arrian and Plutarch.

Diodorus is the author of *Bibliotheca historica* (*Βιβλιοθήκη ιστορική*), the 17th book of which is about Alexander⁸. Its main source is also Cleitarchus. According to Welles, Diodorus also used Callisthenes, Aristobulus, Onesicritus and Nearchus as sources³. The *Bibliotheca historica* also contains the episode where Demophon reprimands the Macedonian, and with sonority Welles translates the passage where Alexander plunged into the city: "He leapt down with his armor alone inside the city". The tree mentioned by Curtius is also part of book XVII. Here, the Macedonian is wounded below the chest (*ὑπὸ τὸν μαστόν*)⁹, then flexing his knees; and in the same way he mortally wounds the archer for having tarnished him. Peucestes is the first one to aid the king; Diodorus refers that others attended later. Alexander required many days on treatment for his injury to be cured⁸.

Trogus' *Historiae Philippicae* have not been preserved to our days. We ignore the date they were created, although Trogus and Diodorus are generally considered writers of the 1st century CE. The sources he used for book XII include Cleitarchus and Callisthenes. Thanks to Justin's *Epitome* is that we know part of Trogus' work; Justin flourished, according to the most popular opinion, at the beginning of third century CE^{3,10}. The epitomist is expectedly briefest, but his version is very similar to that of Curtius: the Macedonian is the first to climb the wall, and when he finds himself alone, he leaps into the city. The tree is also mentioned, as well as the large number of adversaries. At the end, Justin only says that Alexander was wounded by an arrow below the nipple (*sagitta sub mamma*

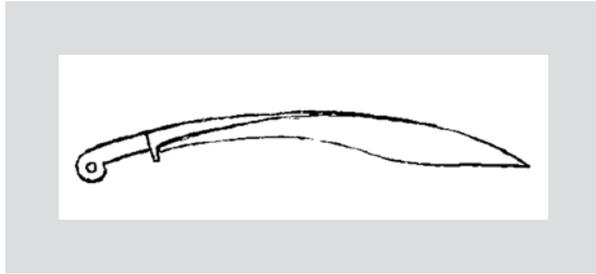


Figure 2. *Koris*(κοπίς)⁵¹.

traiectus), that, bleeding, he fell on his knees and that he killed the archer who wounded him. Gravely, he summarizes the treatment of this injury: “*Curatio vulneris gravior ipso vulnere fuit*”¹¹. Trogus fails to mention those who aided the Macedonian¹⁰.

“On the Fortune or the Virtue of Alexander” (*Περὶ τῆς Ἀλεξάνδρου τύχης ἢ ἀρετῆς*) is comprised by two epideictic orations, which are part of the *Moralia*, composed by Plutarch in his youth, probably in the first half of the 60’s of first century CE. In the first oration, Plutarch imagines what Alexander would say to Fortune: “But my body bears many a token (*πολλὰ σύμβολα*) of an opposing Fortune and no ally of mine”. Immediately, the Macedonian enumerates his war wounds until arriving to the Indian arrow that sank deep in his chest, burying its steel (*καταδύσαντι τὸν σίδηρον*). Plutarch adds a blow on the neck not included by Curtius, and then he wrongly states that Ptolemy covered the king with his shield. In the second oration, Alexander’s wounds are listed again, and when the arrow wound is mentioned, the Chaeronean specifies the length of the projectile, agreeing with Curtius. And he mentions the blow on the neck again. Plutarch further adds that, prior to being hit by the arrow, the Macedonian had been struck on the head through the helmet with a *koris* (*κοπίς*) (Fig. 2) Then he returns to the episode of the Indian archer, where he refers that the arrow had penetrated the bones of his breast (*τοῖς περὶ τὸν μαστὸν ἐνερεισθέντος ὀστέοις*). The shaft was protruded and its iron was four fingers broad and five fingers long. Here, Plutarch and Curtius agree again: the archer, wielding a sword, tries to approach the king, who has him finished by the dagger. With regard to the cervical wound, he details that, from behind, an Indian came out of a mill and struck Alexander on the neck with a truncheon or club (*ὑπέρω*), leaving him unconscious. Having been aided and the Indians defeated, the Macedonian was removed from that place with the cane in his vitals (*τοῖς σπλάγχνοις*) (here, the cane surely refers to the shaft). The projectile was a

bond or bolt holding the breastplate to the king’s body. The iron could not be pulled out, since it was lodged in the firm and solid part (*στερεὰ*) in front of the heart (sternum?) and, owing to the risk of fracture, they hesitated on whether to saw off the shaft or not^{3,12,13}.

Life of Alexander is perhaps one of the most celebrated “Parallel Lives” (*Βιοὶ Παράλληλοι*) and, unlike previous orations, it belongs to the Chaeronean’s maturity, prior to Hadrian’s reign. If we believe, together with Mewalt, that the “Lives” were not published in pairs, but by groups, we can assume that Plutarch wrote the “Life of Alexander” after 99 CE.^{14,15} The Chaeronean’s main source is Aristobolus¹⁶. Here, the narration follows the common course: first, the Macedonian climbed the wall and, being accompanied only by two hypaspists, he leaped into the Indian city. There he confronted adversaries until an archer threw an arrow at him that crossed the breastplate, lodging itself around the bones of the breast (*ἐμπαγῆναι τοῖς περὶ τὸν μαστὸν ὀστέοις*). Due to the sustained wound, he fell on his knees, and the archer approached him with an unsheathed *mákhaira* (*μάχαιρα*). Peucestes and the other hypaspist stepped in, and Alexander slew the attacker. Plutarch refers again the blow on the neck, which he read in Aristobolus. After having been saved, news about his dead multiplied. With great difficulty, the shaft was sawn off in order to remove the breastplate. Then they extracted the iron, which had penetrated one of the bones (*τῆς ἀκίδος ἐνδεδουκίας ἐνὶ τῶν ὀστέων*) and was three fingers broad and four fingers long, which are different dimensions to those the Chaeronean himself had provided in the *Moralia*. During the extraction, Alexander fainted several times and was close to death, but he overcame this trial. And then he was convalescent for a long time (*πολὸν χρόνον*)^{17,18}.

According to Photios, “Anabasis of Alexander” (*Ἀναβάσις Ἀλεξάνδρου*) is the best story written about the Macedonian. Reardon points out that Arrian was an adult when Plutarch died, and his composition is part from the second century CE, c. 130 or 160-165, according to whether it is regarded as an early or late work. In this book, the Nicomedian did not use Callisthenes or Cleitarchus; his main sources were Aristobolus and Ptolemy¹⁹. Arrian stands out for his generous and penetrating style: the Macedonian perceived discouragement among his people and answered this enervation by placing himself a ladder onto the wall, which he climbed protected by his shield. Peucestes followed first and, then, Leonatus climbed using the same ladder, and using another, the *dimoirites* Abreas. As they watched their king, the hypaspists tried to

follow his example by resorting to the ladder that previously had been used by Peucestes and Leonatus, but it was weighed down and shattered, thus preventing them from climbing, and Alexander and his companions from climbing down. The Nicomedian highlights the Macedonian's psychology when, standing erect on the top of the wall, he decided to leap into the city. There, he positioned himself against the wall, since the tree is not present in Arrian, and eliminated, among others, the enemy leader. The Indians attacked him from the distance, this way avoiding the coldness of his sword. Peucestes, Leonatus and Abreas emulated their king by jumping from the wall; the *dimoirites* was then killed by an arrow. Alexander was also wounded, above the nipple (*ὑπὲρ τὸν μαστόν*), by an arrow that penetrated his chestplate^{20,21}. According to the Nicomedian, Ptolemy (*FGrH* 138 F 25) wrote that the Macedonian "exhaled air mixed with blood from the wound" (*πνεῦμα ὁμοῦ τῷ αἵματι ἐκ τοῦ τραύματος ἐξέπνευετο*)^{7,20,21}. In spite of having been wounded, Alexander kept on defending himself until, with an exhalation, he bled profusely and fainted. Arrian does not specify if the Macedonian slew the archer that wounded him. At that moment, Peucestes protected the king behind a shield; Curtius and Arrian agree on this point^{3,20}. However, the Nicomedian characterizes this shield (*ἀσπίδα*) in depth²²: when, in the *Anabasis* first book, Alexander reached sacred Ilion, he slaughtered in honor of fair-haired Athena, and offered his panoply at the holy house and in exchange he took another dedicated to the pale green-eyed maiden since the times of Hector, "champion/supreme of the horse-taming Trojans"^{19,23,24}. Thus, the shield used by Peucestes was part of this consecrated armor.

The state of the king inflamed his army and, after surmounting the earthy wall, they surrounded it with their shields and fought against the Indians from all around. Curtius and Arrian also agree on the exterminating nature of this invasion^{3,20}. The Macedonian was moved away on his shield. The Nicomedian offers two versions about Alexander's wound care: in the first one, Kritodemos (*sic*), an Asclepiad from Kos, made an incision and extracted the arrow; on the other, Perdicas, one of his *somatophylakes* made the incision and immediately pulled the arrow off. Regardless of the version, when the projectile was extracted, he bled abundantly again and fainted once more. Since the Macedonian had to remain on rest at that place, rumors spread that he had died. His army feared and did not believe that he would stay alive after the sustained wound. To calm his men, Alexander had himself

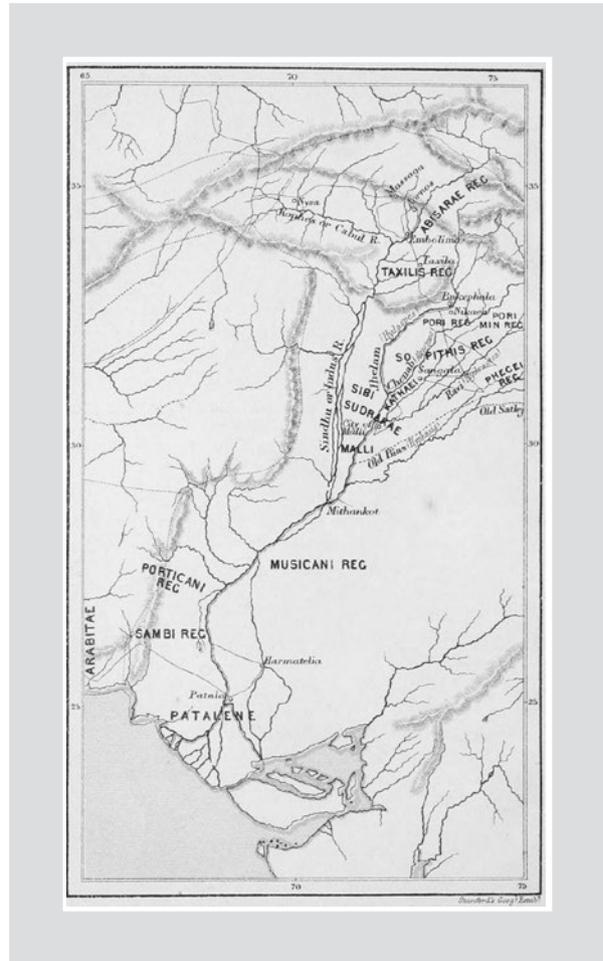


Figure 3. Map of North-eastern India where Alexander expedition is depicted. The city of the Mallians is east of the Indus (or Sindhus) River⁴.

carried along the bank of the Hydraotes River with the prow sunshade folded down in order to be visualized from his army's emplacement, which was stationed at the confluence of the Hydraotes and the Acesines rivers. He stepped down from the boat and rode a horse up to the vicinity of his tent^{20,25}.

Arrian informs that this battle did not occur in the city of the Oxydracians, which Curtius refers to as Sudracae, but in that of the Mallians (Fig. 3)^{3,20}. Strabo, whose work is previous to that of Curtius, agrees with the Nicomedian at this point^{26,27}. Its date slightly differs between commentators, since it was established at 325-326 BCE; Heckel adds that it was autumn back then²⁸⁻³¹. According to Arrian, Ptolemy related that the Macedonian sustained a single wound (*FGrH* 138 F 26a); a version that contrasts with that exposed by Plutarch. However, as Curtius also warns, Ptolemy was absent in this assault (*FGrH* 138 F 26b)^{3,7,12,17,20}.

Discussion

The physicians, the physician. Curtius and Arrian disagree with each other on the identity of whoever treated Alexander's arrow wound^{3,20}. The former claims that Kritoboulos, evoked by Lope in his *Rimas humanas y divinas* (1634)³², performed this task; the latter offers two possibilities: Perdicas or Clitodemus^{3,20} –or Kritodemos (*Κριτόδημον*), according to Iliiff Robson spelling³³–. The Perdicas' hypothesis is, at least, improbable, since allowing for a layman, without the surgeon's instruments, to execute a difficult operation on the king's body lacks verisimilitude, especially if we consider Alexander's education and the physicians he had at his disposition^{30,34}. This possibility is precisely advised against to by Rufus of Ephesus on his *Quaestiones medicinales*. Here we perceive maybe the shadow of good old Homer³⁴.

Only a few characters make a difference between the names of Kritoboulos and Kritodemos. Kind considers that the Nicomedian is wrong and that the one who aided the Macedonian was Kritoboulos (*Κριτόβουλος*), a physician also native from Kos who previously had pulled out an arrow from Philip's eye (Philip was Alexander's father). Berve disagrees and assumes that Curtius had Kritodemos confused with the renowned Kritoboulos³¹. The latter has been identified with one of the trierarchs of Nearchus' expedition^{31,35}. Taking into account the contiguity between this trierarchy and the arrow wound episode, Heckel finds more credible that Arrian made a mistake and that old Kritoboulos took care of the wound³¹, therefore giving Curtius preponderance. Châtillon versified Kritoboulos' episode as well².

Die pfeift mit dem Pneumothorax. In the 19th century, Aubertin acknowledged the fully surgical accuracy Curtius described with the procedure carried out on the Macedonian's body^{3,36}. Arrian's exposure is frugal on this subject, although it does not differ in the fundamental aspects: broadening of the wound by means of an incision²⁰. Bosworth claims that the employed technique complied with medical precepts of that epoch³⁷. During Tiberius reign, on the first half of first century CE, Celsus wrote *De Medicina*, the seventh book of which addresses the third part of the medical art, that which heals by the hand (surgery), and it contains a passage dedicated to arrow wound therapeutics: "The flesh ought to be stretched apart with an instrument like a Greek letter"^{34,38,39}. On his historical review, Emerson did not find in Celsus any allusion to the presence of air in the pleural cavity (pneumothorax)⁴⁰.

To our knowledge, this work is the earliest in Roman medical literature. Wellmann ventures that Celsus simply brought to Latin a previous Greek text, although there are no elements to confirm this statement³⁴.

Although appeared several centuries after the Nicomedian, we used the sixth book of the *Pragmateia* (*πραγματεία*) by Paul of Aegina because perhaps his section on arrow wound treatment originates, at least partially, on a treatise included in the Hippocratic corpus that succumbed to the course of history³⁴. There, barbed arrowheads, such as the one that wounded the Macedonian, are described, and subsequently the Aeginetan specifies that "if, as is likely, the arrow has opposing barbs and will not give away, one has to cut down upon the area near it, if none of the vital parts lie around it, and –having laid bare the arrow– lift it up and extract it without causing laceration". Later he elaborates: "If the arrow has struck a vital part [lit.: if the piercing is in one of the vital parts], such as [...] the lungs [...] and the signs of death are already apparent, and if the extraction would cause much mangling, we refuse [to undertake] the operation, so that we may not, in addition to being of no use, offer laymen and excuse for reproach"⁴¹.

Even when we fail to notice this detail when exposing Curtius version, Kritoboulos expression before the arrow-wounded Macedonian was one of terror, a notorious fact considering his skills³. The warning on previous paragraph allows for us to understand the Asclepiad's attitude, who surely feared an end such as that reserved for Glaucias^{20,28}. As an argument against the pneumothorax diagnosis, Bosworth points out that the technique that, according to Curtius, Kritoboulos used, was only resorted to when internal organs were not involved³⁷. He appears to forget that the Aeginetan adds the following fragment complementing the warning of previous paragraph: "If, however, the outcome is as yet uncertain, one has to operate, having spoken of the danger beforehand, because many have been saved contrary to expectation even after a lesion to the vital parts"⁴¹.

Until relatively recently, penetrating thoracic wounds therapeutic approach was controversial; even during the first years of World War I, these wounds were still treated conservatively⁴². In this scenario, it is easy to assume almost absolute mortality. However, as the Aeginetan writes, "many have been saved contrary to expectation even after a lesion to the vital parts"⁴¹. In chapter 21 of the first treatise "On Diseases" (*Περί νόσων Ι*) we find an example of these survivors: "Those who have an empyema resulting from wounds,

if very deeply wounded by a spear, knife or an arrow, as long as the wound can breathe to the exterior along the original orifice, coldness is introduced through there and heat from there is also emitted, and through there it is cleaned of pus or any other thing. And if the inside and the outside are treated at the same time, it heals completely; while if the outside is healed and the inside is not, then an empyema is formed⁴³. It is also worth mentioning the case of another survivor, Gorgias of Heraclea, of whom we have notice owing to Epidaurus inscriptions⁴⁴.

On late 18th century, Schmieder was perhaps the first to assume Alexander's pneumothorax³⁷. Since Rollet in 1870, secondary sources have been studied as clinical reports by medical writers, setting aside their literary and enlightening nature³⁴. In contemporary medical literature, it is common to assume as a historical fact the supposed pneumothorax suffered by the Macedonian among the Mallians^{28,30,45}, maybe because Arrian narrates it this way²⁰. *Anabasis of Alexander* took this version from Ptolemy (*FGrH* 138 F 25), the description of which (*πνεῦμα ὁμοῦ τῷ αἵματι ἐκ τοῦ τραύματος ἐξεπνεῖτο*) reminds us of that by the Aeginetan^{7,20,21}: "Diagnosis of wounds to the vital parts is not difficult and is made by way of the specific character of the symptoms, of what is excreted [through the wound], and on account of the position of the parts. [...] When the lung is wounded, frothy blood [*ἀφρώδες αἷμα*] is evacuated through the wound"⁴¹. In Ptolemy's *pneuma* (*πνεῦμα*), Lammert finds not air, but that other *pneuma* described by Diocles^{37,46}. We do not know whether Ptolemy read the physician of Carystus; all we can say is that Diocles probably flourished in late fourth century BCE and that Ptolemy was already old and reigned over Egypt when he wrote about Alexander^{3,47}. Bosworth judges this risky conjecture by Lammert to be desperate³⁷. In addition, also Curtius, who belongs to the vulgate, narrates that it appeared that the arrowhead had penetrated down to the viscera (*et penetrasse in viscera videbatur*), or rather, as Heitland and Weller interpret on their notes, down to the right lung^{3,4}.

Curtius details that Alexander's wound healed in seven days³. In Arrian's account, the Macedonian rode among his men to put an end to rumors about his death²⁰. However, it is absurd that Alexander could have been able to ride barely two days after having suffered a pneumothorax, as Bosworth points out³⁷, especially considering the lethality of this complication in an era where therapeutic possibilities were notoriously limited. Simpson also doubts that the Macedonian's arrow wound had caused a pneumothorax, since he considers Plutarch's version more plausible⁶.

On the other hand, in case the Chaeronian's fidelity is greater, the Aeginetan proposes that: "if the arrow has struck a bone, we try again [to remove it] with the instrument, and if the flesh prevents this, we remove it all around or dilate it. If it [i.e. the arrow] is stuck deep in a bone (we recognize this from the fact that it is firmly fixed and does not give way when we apply force), we remove the surrounding bone with knives for excising or, having drilled [the bone] all around first, if it is thick, we loosen the arrow". And then he specifies: "[If it is] in the chest, if it does not follow [i.e. if it cannot be withdrawn easily], one has to draw out the arrow by a moderate incision of the intercostal space, or even after having cut out one of the ribs, placing a meningophylax underneath"⁴¹.

Although "it is vain and foolish to talk of knowing Greek", as Virginia Woolf wrote⁴⁸, in an attempt to minimize misrepresentations such as those noticed by York and Steinberg⁴⁹, the fundamental fragments used for this study were consulted and quoted in their original language. We also used Celsus and the Aeginetan in order to circumvent the risk of proposing an anachronistic diagnosis.

Conclusion

We believe (together with José Emilio Pacheco) that "Alexander [or that series of words we identify with Alexander] would not have been Alexander without [...] the bravery that always drove him to fight at first line in front of his army"⁵⁰. To this fearfulness owes the Macedonian the arrow he lodged in his chest, which surely remained stuck in the rib cage until its removal by Kritoboulos. The events occurring after the arrow wound render the possibility of a pneumothorax implausible.

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References

1. Borges JL. El falso problema de Ugolino. *La Nación*, 30 de mayo de 1948.
2. Châtillon GD. Pejenaute-Rubio F, traductor. *Alejandreida*. Madrid: Akal; 1998. p. 292.
3. Curcio. Pejenaute-Rubio F, traductor. *Historia de Alejandro Magno*. Madrid: Gredos; 1986. p. 7-70 y 514-21.
4. Heitland MA, Raven TE, editores. *Alexander in India: a portion of the history of Quintus Curtius*. Cambridge: Cambridge University Press; 1905. p. 33f y 152-6.

5. Connelly T, Higgins T. Diccionario nuevo y completo de las lenguas española e inglesa, inglesa y española, p. II, t. I. Madrid: Imprenta Real; 1797. p. 75.
6. Simpson JY. Was the Roman army provided with any medical officers? En: Archaeological essays, vol. II. Edimburgo: Edmonston and Douglas; 1872. p. 197-227.
7. Jacoby F. Ptolemaios Lagu (138). En: Die Fragmente der Griechischen Historiker Part I-III. Brill Online, 2015. 16 de mayo de 2015. Disponible en: <http://referenceworks.brillonline.com/entries/die-fragmente-der-griechischen-historiker-i-iii/ptolemaios-lagu-138-a138>
8. Diodoro. Welles CB, traductor. Diodorus of Sicily, vol. VIII. Cambridge, Massachusetts: Harvard University Press; 1963. p. 403-5.
9. Diodoro. Fischer KT, editor. Diodori Bibliotheca Historica, vol. IV. Stuttgart: Teubner; 1964. p. 285.
10. Justino. Castro-Sánchez J, traductor. Epítome de las "Historias filípicas" de Pompeyo Trogo. Madrid: Gredos; 1995. p. 7-54 y 243-4.
11. Justino. Pirot J, Boitard E, traductores. Histoire universelle de Justin, extraite de Trogue Pompée, t. I. Paris: Panckoucke; 1833. p. 274-5.
12. Plutarco. López-Salvá, traductor. Sobre la fortuna o la virtud de Alejandro. En: Obras morales y de costumbres (Moralia), vol. V. Madrid: Gredos; 1989. p. 225-84.
13. Plutarco. Babbitt FC, traductor. On the fortune or the virtue of Alexander. En: Moralia, vol. IV. Londres: Heinemann; 1962. p. 379-487.
14. Plutarco. Pérez-Jiménez A, traductor. Vidas paralelas, t. I. Madrid: Gredos; 1985. p. 7-147.
15. Jones CP. Towards a chronology of Plutarch's Works. JRS. 1966;56:61-74.
16. Hammond NGL. Sources for Alexander the Great. Cambridge: Cambridge University Press; 2007. p. 115-9.
17. Plutarco. Bergua-Cavero J, traductor. Vidas paralelas, t. VI. Madrid: Gredos; 2007. p. 9-13 y 108-9.
18. Plutarco. Perrin B, traductor. Plutarch's lives, vol. VII. Londres: Heinemann; 1919. p. 402-5.
19. Arriano. Guzmán-Guerra A, traductor. Anábasis de Alejandro Magno, Libros I-III. Madrid: Gredos; 1982. p. 7-95 y 150.
20. Arriano. Guzmán-Guerra A, traductor. Anábasis de Alejandro Magno, Libros IV-VIII (India). Madrid: Gredos; 1982. p. 149-56, 224 y 291.
21. Muckensturm-Pouille C. Alexandre chez les Malles: techniques d'un récit dans l'Anabase d'Arrien. DHA. 2010;4(Suppl 4-2):371-82.
22. Arriano. Abicht K. Arrian's Anabasis. Leipzig: B.G. Teubner Verlag; 1871. p. 124.
23. Reyes A. Obras completas, vol. XIX. México: FCE; 2000. p. 219.
24. Homero. Bonifaz-Nuño R, traductor. Iliada I-XII. México: UNAM; 1996. p. 104-5.
25. Heckel W. The "Somatophylakes" of Alexander the Great: some thoughts. Historia. 1978;27:224-8.
26. Estrabón. García-Blanco J, traductor. Geografía. Libros I-II. Madrid: Gredos; 1991. p. 100-2.
27. Estrabón. Hamilton HC, Falconer W, traductores. The Geography of Strabo, vol. III. Londres: Bell & Sons; 1906. p. 94-5.
28. Lascaratos J, Dalla-Vorgia P. Defensive medicine: two historical cases. Int J Risk Saf Med. 1996;8:231-5.
29. Retief FP, Cilliers L. The death of Alexander the Great. Acta Theol. 2006;26(Suppl 7):14-28.
30. Retsas S. Alexander's (356-323 BC) expeditionary medical corps 334-323 BC. J Med Biogr. 2009;17:165-9.
31. Heckel W. Two doctors from Kos? Mnemosyne. 1981;34:396-8.
32. Vega LD, Cuiñas-Gómez M, editores. Rimas humanas y divinas del Licenciado Tomé de Burguillos. Madrid: Cátedra; 2008. p. 135.
33. Arriano. Iloff Robson E, traductor. Arrian, vol. II. Londres: Heinemann; 1933. p. 133.
34. Salazar CF. The treatment of war wounds in Graeco-Roman Antiquity. Leiden: Brill; 2000.
35. Heckel W. Who's who in the age of Alexander the Great: prosopography of Alexander's empire. Oxford: Wiley-Blackwell; 2006. p. 100.
36. Aubertin C. Del servicio médico en los ejércitos de la antigüedad (II). Revista de Sanidad Militar y General de Ciencias Médicas. 1866; 51:82-8.
37. Bosworth AB. Alexander and the East: the tragedy of triumph. Oxford: Oxford University Press; 1996. p. 62-4.
38. Celso. Spencer WG, traductor. De Medicina, vol. III. Londres: Heinemann; 1961. p. 315-9.
39. Köckerling F, Köckerling D, Lomas C. Cornelius Celsus – ancient encyclopedist, surgeon-scientist, or master of surgery? Langenbecks Arch Surg. 2013;398:609-16.
40. Emerson CP. Pneumothorax: a historical, clinical, and experimental study. Johns Hopk Hosp Rep. 1903;11:1-450.
41. Salazar CF. Getting the point: Paul of Aegina on arrow wounds. Sudhoffs Arch. 1998;82:170-87.
42. Ellis H. A history of surgery. Londres: Greenwich Medical Media Ltd.; 2001. p. 213-4.
43. VV.AA. Alamillo-Sanz A, Lara-Nava MD, traductores. Tratados hipocráticos, vol. VI: Enfermedades. Madrid: Gredos; 1990. p. 58-9.
44. Hipócrates. Alsina J, traductor. Tratados médicos. Barcelona: Anthropos; 2001. p. X.
45. Oldach DW, Richard RE, Borza EN, Benitez RM. A mysterious death. N Engl J Med. 1998;338:1764-9.
46. Lammert F. Alexanders Verwundung in der Stadt der Maller und die Damalige Heilkunde. Gymnasium. 1953;60:1-7.
47. Jaeger W. Diocles of Carystus: a new pupil of Aristotle. Phil Rev. 1940;49:393-414.
48. Woolf V. On not knowing Greek. En: The common reader: first series. Londres: Hogarth Press; 1925. p. 24.
49. York GK, Steinberg DA. Commentary. The diseases of Alexander the Great. J Hist Neurosci. 2004;13:153-6.
50. Pacheco JE. La noche inmortal. En: La sangre de Medusa, y otros cuentos marginales. México: Era; 1991. p. 29.
51. Cowper HS. The art of attack. Ulverston: Holmes; 1906. p. 133.