Gross pathological diagnosis of pygomelia in association with other anomalies in a 3-week old Chick-layer

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**ABSTRACT**

Malformations may be found in chickens with or without fatal consequences depending upon the nature of such anomalies and their ability to interfere with the normal physiology of affected birds. The present report aimed to document a case of polymelia in general, and pygomelia in particular, in association with other anomalies in a 3-week old Chick-layer. A post-mortem examination was carried out on the Chick-layer immediately following death from wild rat’s attack in a make-shift metal isolation pen while awaiting clinical examination. Although the Chick-layer looked slightly smaller than its peers on the average, it was in a fair body condition. The Chick-layer had a pasted vent. It also had a pair of legs attached to the pelvis beneath the left side of it layer. The continuous documentation of the various forms of this condition with their associated anomalies will enrich our knowledge base in the subject matter for a better understanding of the triggers, pathogenesis, management, and the prevention/control measures against these developmental anomalies in affected birds.

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**Introduction**

Several authors have reported different congenital abnormalities in domestic animals (Newman et al., 1999; Noh et al., 2003; Alam et al., 2007). The presence of accessory limb(s) attached to any part of the body is known as polymelia (Hiraga et al., 1989; Fourie, 1990), which is a Greek word meaning supernumerary limbs in both animals and birds (Abu-Seida, 2014). Polymelia is classified variously as cephalomelia, notomelia, thoracomelia, and pygomelia if these accessory legs are attached to the head, vertebral column, thorax, and the pelvis, respectively (Rahman et al., 2006; Shojaei et al., 2007). Besides, polymelia may be associated with other anomalies depending on the cause and developmental manifestations (Hassanzadeh and Rahemi, 2017). Such limbs are usually smaller than usual with stiff joints and de-innervated sparse muscles (Pohlmeyer, 1975). Although there are different reports on polymelia in humans, calves, goats, ewes, and poultry (Hiraga and Dennis, 1993; Ramadan et al., 1998; Schönfelder et al., 2003; Talamillo et al., 2005), true polymelia rarely occurs in chickens (Anderson et al., 1985; Abu-Seida 2014). Therefore, any form of polymelia in birds is worth documenting whenever it does occur, especially when in association with other anomalies. More so, that notomelia is reportedly the commonest with pygomelia rarely occurring among reported polymelia cases (Mistry et al., 2010). These congenital anomalies are said to be associated with genetic factors, teratogenic agents, drugs, and environmental factors (Keeler et al., 1981; Albarella et al., 2009; Newman et al., 1999). Others include exposure to toxic or radioactive chemicals (Albers et al., 2001), as well as the effect of vitamins (Bruschelli and Rosi, 1971) and absolute humidity of between 0.029–0.031 kg/m³ arising from a high incubation temperature of 38.9°C and relative humidity range of 60-65%, according to Noiva et al. (2014). However, according to Bahador et al. (2007), we are yet to fully comprehend the precise regulatory mechanism of these developmental anomalies. Therefore, there is a need to lay a foundation for future investigations into understanding the pathogenesis and preventive measures against the condition in affected chickens. That is why the present report aimed to document the presence of polymelia, particularly pygomelia, in association with other anomalies in a 3-week old Chick-layer following a post-mortem examination. Moreover, most polymelia cases so far reported involved ante-mortem investigations of the condition in affected chickens (Anderson et al., 1985; Ajayi and Mailafia, 2011; Hirschberg et al., 2012; Azeez and Oyagbemi,
2013; Abu-Seida, 2014; Hassanzadeh and Rahemi, 2017), unlike the present case.

**Case description**

A 3-week old Chick-layer, among a flock of 500 birds, reportedly had a pair of extra-legs attached to its caudal part. The Chick-layer, on Hydrid chick mash (Hybrid Feeds Limited, Kaduna, Nigeria), have been vaccinated against Newcastle disease (i/o at day old) and infectious bursal disease (PO at day 9th and 22nd of age). The poultry attendant reportedly isolated the affected Chick-layer in a make-shift metal isolation cage away from the rest flock to be examined clinically. However, wild rats attacked and killed the Chick-layer in the make-shift isolation metal cage before it could be clinically examined and was immediately presented for post-mortem examination. The time lapse between the death of the Chick-layer and post mortem examination of the carcass was about 35 minutes.

The Chick-layer was in fair body condition. Further examination revealed the presence of a pair of accessory legs and pasted vent area with brownish to yellowish green faecal material. The poorly developed and suspended non-functional pair of accessory legs was attached to the pelvis by a band of cartilage on the left ventro-lateral side of the base of the coccygeal vertebrae (Plate 1). The attachment of the extra-legs pushed the coccygeal vertebrae and the cloaca to the right side of the chick (Plate 1). The flexion direction of the knee and tarsal joints of the accessory legs were in the opposite direction to the healthy limbs (Plate 1). There were no visible gross changes in the lung, heart, liver, spleen, and kidneys of the chick (Plate 2). However, the rectum was dilated and impacted with semi-solid faecal materials into the cloaca (Plates 2 and 3) in addition to the presence of three separate ceca instead of the usual two ceca at the ileocecal junction (Plate 3).

![Plate 1](image1.jpg)

**Plate 1.** Photograph of the dorso-caudal part of a 3-week old Chick-layer showing the presence of a pair of accessory limbs (white arrows) attached to the pelvis on the left ventro-lateral side of the coccygeal vertebrae (black arrow) by a band of cartilage (black arrowhead) whose knee joint flexion (double white arrowheads) and tarsal joint flexion (white arrowhead) are in opposite direction to those of the healthy legs (X).
Discussion
The comparatively reduced size of the Chick-layer compared to its peers might be attributable to reduced feed consumption occasioned by gut fullness or distension. This is because, although not yet fully understood compared to other factors, gut distension and gut motility are known to influence feed intake (Ferket and Gernat, 2006). Gut fullness or distension in the present case might have arisen from the partial blockage of the cloacal orifice by the accessory legs with surrounding feathers in addition to the misalignment of the cloaca to the right of the Chick-layer. Although genetic, environmental or a combination of both factors could have caused the observed pygomelia, the actual cause of the condition in animals are not fully comprehended (Bahador et al., 2007). The accessory legs and surrounding feathers partially blocked the cloacal orifice thereby interfering with the normal free voiding of faeces leading to the observed accumulation of faecal material within the dilated rectum/cloaca. The possible pathogenesis of the rectal/cloacal impaction in the present case was not among the failure to pass eggs and the presence of foreign bodies, infection, cloacoliths, and loss of tone suggested by Lumeji (1994). Besides, sudden increase in brooding temperature leading to increased thirst and the passage of watery stool that touches to hang on the accessory legs and the surrounding feathers, which rapidly dry to leave some faecal crusts around the area, might also account for the pasted vent area. Such birds eventually become runts, as in the present case, as they cannot comparatively compete with their bigger peers for easy access to adequate feed and water consumption, including ample space. The possible sequela of rectal/cloacal impaction in affected chickens might be renal failure and visceral gout, if it blocks the ureters (Lumeji, 1994). Poor feed conversion ratio could have also caused the observed poor body size or growth in the affected Chick-layer compared to its peers.

Although pygomelia, a form of polymelia, has been reported in a 9-week old grower broiler bird in Abuja, Nigeria (Ajayi and Mailafia, 2011), the location of the accessory limbs in the present case differed from those of that particular case. Similarly, the present case is reported in a much younger Chick-layer (3-week old) compared to in a much older 9-week old male broiler by Ajayi and Mailafia (2011). Moreover, the present case reports the presence of accessory legs attachment to the pelvis rather than to the coccygeal vertebrae reported by Azeez and Oyagbemi (2013). The observation of opposite knee and tarsal joints directional flexion of the accessory limbs compared to the normal ones is consistent with the report of Hassanzadeh and Rahemi (2017). Similarly, the poorly developed musculature of the accessory legs compared to those of the fully developed functional legs is consistent with earlier findings (Ajayi and Mailafia, 2011; Azeez and Oyagbemi, 2013). Although
Plate 3. Photograph of the hind gut of a 3-week old Chick layer showing the three ceca (black arrows) with the dilated rectum/cloaca (white arrow).

Hirschberg et al. (2012) also reported the presence of three separate ceca with a normal rectum that branched into a paired cloaca, this particular case reports the presence of three ceca with a dilated and faecal material-impacted rectum, and a single cloaca. The observed polymelia and cecal anomalies might be due to genetic aberrations or just a mere coincidence that needs further elucidation in future cases. The presence of both polymelia and three ceca in birds notwithstanding, the present case report did not attempt to determine the causal relationship between them. Perhaps, the determination of their causal relationship might become the focus of investigations of future cases. This is because the observed ceca may or may not have been associated with the pygomelia until fully elucidated. However, the observed differences between the cecal and rectal/cloaca anomalies in the present case compared to those reported by Hirschberg et al. (2012) showed that anomalies associated with polymelia vary in chickens. Beyond the investigation of the pathogenesis of the presence of the three separate ceca in these birds, we need to further elucidate on the sequela of the condition as the nutritional significance of the usual two ceca in poultry remains unclear (Svihus et al., 2013). Affected birds can live normal lives where the accessory legs are non-functional, as seen in the present case, and does not interfere with their normal physiology. However, in cases where such accessory legs interfere with the existence of the affected birds, continuous vent pasting in the present case, surgical intervention becomes recommended in highly prized or valued birds. This case report presents the gross morphological manifestations of pygomelia in association with cecal and rectal anomalies in a Chick-layer following a gross post-mortem examination unlike clinical evaluation of the condition in affected birds (Anderson et al., 1985; Ajayi and Mailafia, 2011; Hirschberg et al., 2012; Azeez and Oyagbemi, 2013; Abu-Seida, 2014; Hassanzadeh and Rahemi, 2017). The evaluation of the chromosomal make-up of the chick would have given further insights into the possible genetic aberrations associated with the condition in this particular bird.
In conclusion, pygomelia in birds is a rare condition that might be of no life-threatening consequences. However, some might have grave consequences when associated with some other peculiar anomalies, as seen in the present case. This case is the first report of pygomelia in association with some peculiar cecal and rectal anomalies in a Chick-layer based on current available information.

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Conflict of interest

The authors privately funded the work, and therefore, declare no conflict of interest

References

Abu-Seida, A.M. (2014). Amputation of polymelia in a layer chicken. Avian Diseases, 58: 330-332.

Ajayi, I. E. and Mailafia, S. (2011). Occurrence of polymelia in 9-week-old male broiler: Anatomical and radiological aspects. Journal of Veterinary Anatomy, 4: 69-71.

Albarella, S., Ciotola, F., Dario, C., Iannuzzi, L., Barbieri, V. and Peretti, V. (2009). Chromo-some instability in Mediterranean Italian buffaloes affected by limb malformation (Transversal hemimelia). Mutagenesis, 24: 471-474.

Alam, M.R., Lee, J.I., Lee, H.B., Ko, J.J., Lee, K.C. and Kim, N.S. (2007). Supernumerary ectopic limbs in Korean indigenous cattle: Four case reports. Veterinarni Medicina, 52: 202–206.

Albers, P.H., Hoffman, D.J. and Brisbin, I.L. (2001). Unusual leg malformations in screech owls from a South Carolina Superfund site. Journal of Toxicology and Environmental Health A, 63: 89–99.

Anderson, W.I. Langheinrich, K.A. and Mecaske, P.C. (1985). Polymelia in a broiler chicken. Avian Diseases, 29: 244-245.

Azeez, O.I. and Oyagbemi, A.A. (2013). First report of polymelia and a rudimentary wing in a Nigerian Nera black chicken. Journal of the South African Veterinary Association, 84. doi: 10.4102/jsava.v84i1.1082

Bahador, S., Majid, M. and Ali, A. (2007). Notomelia and unlar dimelia in a calf: Radiographical anatomic aspects. Iranian Journal of Veterinary Surgery, 2: 83-86.

Bruschelli, G.M. and Rosi, G. (1971). Polymelia induced by vitamin A in larvae of Bufo vulgaris. Rivista di Biologia, 64: 271–283.

Fourie, S.L. (1990). Congenital supernumerary ectopic limbs in a Brahman-cross calf. Journal of the South African Veterinary Association, 61: 68-70.

Ferket, P.R. and Gernat, A.G. (2006). Factors that affect feed intake of meat birds: A review. International Journal of Poultry Science, 5: 905-911.

Hassanzadeh, B. and Rahemi, A. (2017). Polymelia with unhealed navel in an Iranian indigenous young fowl. Veterinary Research Forum, 8: 85-87.

Hiraga, T. and Dennis, S. (1993). Congenital duplication. The Veterinary Clinics of North America, Food and Animal Practice, 9: 145-161.

Hiraga, T., Abe, M., Iwasa, K., Takehana, K. and Tetsuka, M. (1989). Seven-legged calf-dipgyus with an extra foreleg at the pelvic region. Nihon Juigaku Zasshi, 51: 1011-1015.

Hirschberg, R.M., Saleh, M., Kaiser, S., Lierz, M., Hafez, M.H. and Bragulla, H.H. (2012). Polyelomous layer chick displaying additional malformations of the hind gut: Case report and in-depth review of related literature. Anatomia Histologia and Embryologia, 41: 262–273.

Keefer, R.F., Shupe, J.L., Crow, M.W., Olson, A. and Balls, L.D. (1981). Nicotiana glauca-induced congenital deformities in calves: Clinical and pathologic aspects. American Journal of Veterinary Research, 42: 1231-1234.

Lumei, J.T. (1994). Gastroenterology. In: Avian Medicine: Principles and Application. Wingers Publishing, Lake Worth, Fl, pp 482-521.

Mistry, J.N., Patel, P.B., Suthar, D.N. and Patel, J.B. (2010). Fifth legged pygomelia in a cross bred cow calf. Veterinary World, 3: 512-512.

Newman, S.J., Bailey, T.L., Jones, J.C., Diggrassie, W.A. and Whittier, W.D. (1999). Multiple congenital anomalies in a calf. Journal of Veterinary Diagnostic Investigation, 11: 368-371.

Noh, D.H., Jeong, W.I., Lee, C.S., Jung, C.Y., Chung, J.Y., Lee, Y.H., Do, S.H., An, M.Y., Kwon, O.D., Williams, B.H. and Jeong, K.S. (2003). Multiple congenital malformation in a Holstein calf. Journal of Comparative Pathology, 129: 313-315.

Noiva, R.M., Menezes, A.C. and Peleiteiro, M.C. (2014). Influence of temperature and humidity manipulation on chicken embryonic development. BMC Veterinary Research, 10: 234-244.

Pohlmeier, K. (1975). Notomelie beim Kalb. Dtsch [Notomelia in a calf]. Dtsch Tierärztl Wochenschr, 82: 190-195.

Rahman, M., Khan, M., Biswas, D., Sutradhar, B.C. and Saifuddin, A.K. (2006). Pygomelia or supernumerary limbs in a crossbred calf. Journal of Veterinary Science, 7: 303-305.

Rahmadan, R., Abdin-Bey, M. and Al-Holaihi, A. (1998). Notomelia in goats and calves. Pakistan Veterinary Journal, 18: 47-49.

Schönfelder, A., Wittek, T. and Sobiraj, A. (2003). The calf polymelia – Overview with case descriptions for surgical remediation. Veterinary Practice Edition G: Large Animals – Farm Animals, 31: 314-318.

Shojaei, B., Masoudifard, M. and Asadi, A. (2007). Notomelia and unlar dimelia in a calf: Radiographical anatomic aspects. Iranian Journal of Veterinary Surgery, 2: 83-88.

Svihus, B., Choct, M. and Classen, H.L. (2013). Function and nutritional roles of the avian caeca: A review. World's Poultry Science Journal, 69: 249-264.

Talamillo, A., Bastida, M.F., Fernandez-Teran, M. and Ros, M.A. (2005). The developing limb and the control of the number of digits. Clinical Genetics, 67: 143-153.