Polyserositis in intensive swine production: a case study of high morbidity and mortality

[1]Andrei Ungur

[1] Department of Porcine Health Management, Faculty of Veterinary Medicine, University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca, Romania. Corresponding author: A. Ungur, andrei.ungur@usamvcluj.ro

Abstract. Polyserositis is a severe inflammatory condition in pigs, characterized by the inflammation of multiple serosal membranes, including the pleura, pericardium, and peritoneum. This report describes an outbreak of polyserositis in an intensive finishing unit of 800 pigs, where 20% of the herd exhibited clinical signs, leading to a mortality rate of 16% (128 pigs). The outbreak occurred despite the farm's adherence to high biosecurity and hygiene standards, highlighting the challenges of managing bacterial diseases in intensive swine production systems.

Clinical signs included apathy, respiratory distress, abdominal breathing, and fever, progressing rapidly over a one-week period. Post-mortem investigations revealed extensive fibrinous adhesions affecting both abdominal and thoracic cavities, with findings consistent with a systemic bacterial etiology. Treatment involved the administration of amoxicillin in drinking water, along with intramuscular long-acting penicillin and meloxicam for affected pigs. While clinical signs improved following treatment, growth rates and feed conversion ratios were severely affected in surviving pigs, emphasizing the economic impact of the outbreak.

The absence of vaccination protocols at the source farm was identified as a potential predisposing factor. The report underscores the importance of robust vaccination programs, stress minimization, and enhanced diagnostic measures to prevent and mitigate such outbreaks. This case provides valuable insights into the multifactorial nature of polyserositis and the critical need for proactive health management strategies in modern swine production systems.

Key Words: bacterial infections, biosecurity, Glässer's disease, vaccination.

Introduction. Polyserositis is a severe inflammatory condition in pigs, characterized by simultaneous inflammation of multiple serosal membranes, including the pleura, pericardium, and peritoneum. It is a condition of major economic concern in swine production systems worldwide, particularly during the growing and finishing stages, as it can lead to high morbidity and mortality rates, thereby significantly impacting productivity and profitability (Cai et al 2005). The condition often manifests as part of systemic disease, with clinical signs such as fever, respiratory distress, and sudden death, making early diagnosis and management critical (Zimmerman et al 2019).

The etiology of polyserositis is typically bacterial, with *Glaesserella parasuis* (formerly *Haemophilus parasuis*) being one of the most significant pathogens implicated. It is the causative agent of Glässer's disease, which presents with fibrinous inflammation of serosal surfaces, arthritis, and meningitis (Gottschalk et al 2010). Other common bacterial culprits include *Mycoplasma hyorhinis*, which primarily affects weaning pigs, and *Streptococcus suis*, a zoonotic pathogen capable of causing meningitis, septicemia, and arthritis in pigs and humans alike (Segura et al 2014; Aragon et al 2019).

Environmental stressors such as poor ventilation, overcrowding, abrupt dietary changes, and transport exacerbate susceptibility to these pathogens, often serving as triggers for clinical outbreaks (Lowe et al 2005). Viral coinfections, including those caused by porcine reproductive and respiratory syndrome virus (PRRSV) and swine influenza virus (SIV), can further compromise the immune system, leading to increased disease severity (Palzer et al 2015).

Diagnostic efforts rely heavily on clinical observation, necropsy findings, and laboratory tests. Gross lesions, including fibrinous exudates on serosal surfaces and polyarthritis, are hallmark signs. Confirmatory tests such as bacterial culture, polymerase chain reaction (PCR), and serotyping provide definitive identification of the causative agent (Olvera et al 2009; Petrocchi-Rilo et al 2021).

Recent studies have delved into the pathogenesis of these infections, shedding light on the role of virulence factors, including capsular polysaccharides and surface proteins, in immune evasion and tissue colonization. These insights are critical for the development of effective vaccines and therapeutics (Macedo et al 2021; Willemse et al 2016).

This report details a severe outbreak of polyserositis affecting approximately 20% of a finishing herd of 800 pigs. The objectives are to provide a comprehensive overview of the clinical presentation, diagnostic findings, and management strategies, while also discussing preventive measures to mitigate future outbreaks in intensive swine production systems.

Case description

Farm. The case occurred on an intensive finishing unit with a total capacity of 800 pigs. The farm operates a well-organized production system, populating the unit with 10-week-old piglets averaging 27 kg. The pigs are grown and finished over a 12-week period until they reach an average weight of 120 kg at the time of sale.

The farm adhered to good biosecurity standards. A robust hygiene filter was in place for personnel, ensuring controlled access to the facility. The premises were secured by a double fence to prevent potential breaches from external sources. The production system followed an "all-in, all-out" approach, allowing for thorough cleaning and disinfection between production cycles. Additionally, the farm maintained proper hygiene and welfare parameters, aligning with recommended standards for modern swine production (Figure 1).

The outbreak described in this report occurred when the pigs had reached an average weight of 50-60 kg, approximately 15 weeks of age and during the 5th to 6th week of the growing/finishing period. Despite the well-maintained biosecurity and hygiene measures, the morbidity and mortality associated with this outbreak underscored the challenges of managing certain bacterial diseases even under optimal farm management conditions.

Figure 1. (A) The double fencing system implemented on the farm ensures high biosecurity by preventing unauthorized access and potential disease transmission from external sources. (B) Inside view of the farm showcasing the well-maintained hygiene standards, including clean floors and organized facilities, aligned with recommended practices for modern swine production systems (original image).

Clinical signs. Approximately 20% of the pigs in the herd exhibited clinical signs consistent with severe systemic illness. The initial symptoms, observed in about 5% of the

pigs during the first few days, included apathy, depression, and prolonged recumbency. These signs were mild initially but progressed rapidly over the following days.

By one week after the onset of clinical signs, the condition had worsened significantly, affecting 20% of the pigs. The affected animals displayed severe depression, pronounced apathy, difficulty in breathing, abdominal breathing, oral breathing, severe coughing, and anorexia. Fever was also noted as a prominent clinical feature during this stage.

The disease continued to progress, and approximately 100 pigs succumbed to the condition within 10 days of the first clinical signs being observed. The rapid escalation in the severity and extent of the outbreak underscored the aggressive nature of the disease and the challenges in controlling it under intensive production conditions.

Post-mortem investigation. To investigate the outbreak, necropsies were performed on 10 pigs that had died no more than three hours before the farm visit. The external examination of the carcasses revealed distended abdomens, foamy nasal discharge, and a mild to moderate degree of cyanosis on the external mucosae. The body condition scores of the carcasses ranged between 2 and 3.

Upon opening the abdominal cavity, all 10 cadavers exhibited a moderate to severe degree of polyserositis. The abdominal organs were adhered to one another by a massive, gelatinous, yellowish fibrinous material, creating the appearance of a single, solid mass within the abdominal cavity. Once the adhesions were carefully separated, it was evident that the serosal surfaces of all organs were affected, showing extensive fibrinous deposits. A moderate level of congestion was noted in all abdominal organs, with visibly enlarged (ectatic) blood vessels (Figure 2).

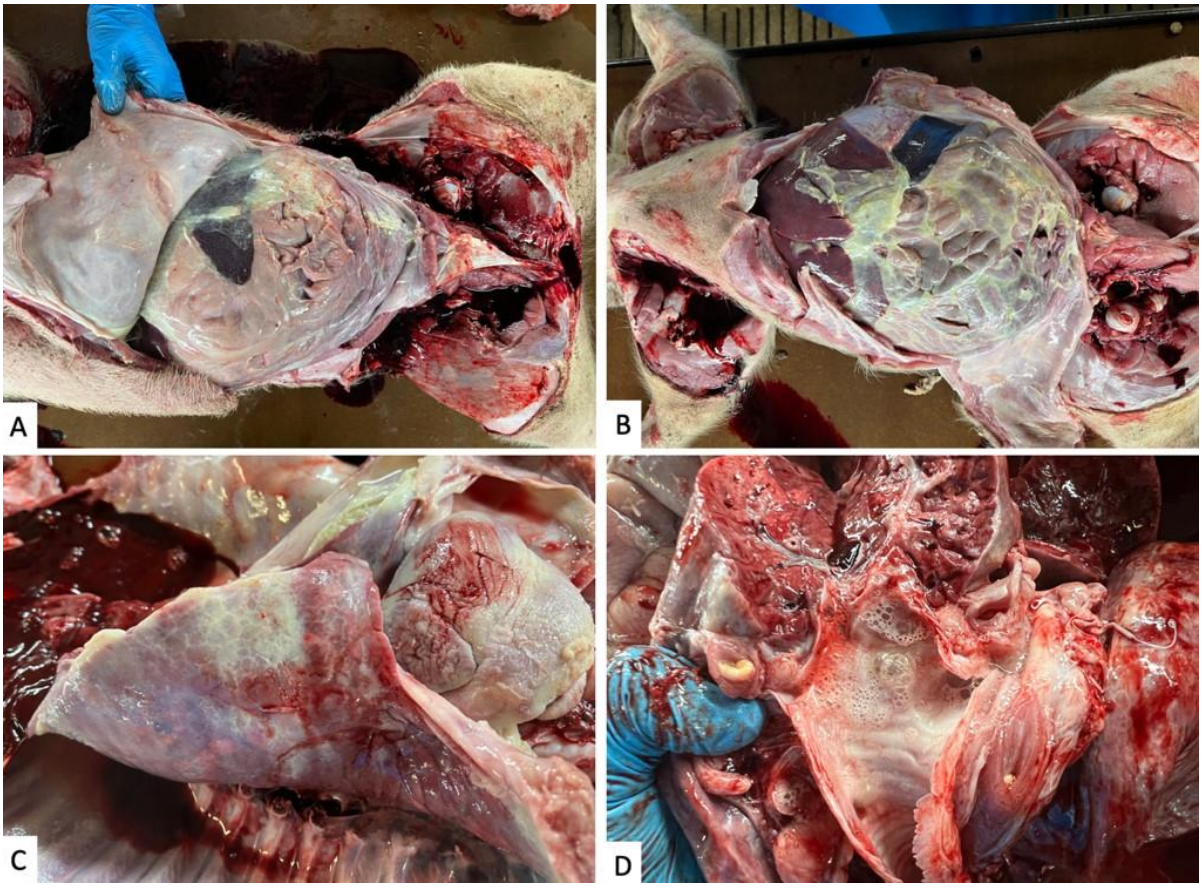

Figure 2. (A, B) Severe polyserositis in the abdominal cavity, with massive gelatinous, yellowish fibrinous material adhering abdominal organs together, creating a single consolidated mass. After separation, extensive fibrinous deposits and congestion are visible on the serosal surfaces of all organs. (C) Thoracic cavity findings include severe pleuritis

with fibrinous adhesions on the lungs and pericardium. The epicardium shows a diffuse fibrinous deposit firmly attaching it to the pericardium. (D) Lungs display cranioventral consolidation and significant edema, with a dense consistency. Opening the trachea and main airways reveals a substantial accumulation of foamy fluid, consistent with interstitial and alveolar edema and multifocal interstitial hemorrhages (original image).

The thoracic cavity showed similar findings. Severe pleuritis was observed, with adhesions so robust that parts of the lung tissue were torn during the removal of the sternum. The pericardial sac was thickened and adhered to both the pleura and epicardium. The pericardial fluid was abnormal, presenting as a thick, yellowish-white, gelatinous substance. The epicardial surface exhibited a diffuse fibrinous deposit, firmly attaching it to the pericardium. The myocardium showed moderate to severe hypertrophy.

The lungs displayed a moderate layer of white-yellowish fibrinous deposits on their surfaces. They were uncollapsed and exhibited a dense consistency, with cranioventral consolidation. Upon opening the trachea and main airways, a significant accumulation of foamy fluid was observed. Examination revealed interstitial and alveolar edema, along with multifocal interstitial hemorrhages.

These necropsy findings highlighted the extensive and severe nature of the polyserositis, with both thoracic and abdominal cavities severely affected. The pathological changes indicated a systemic inflammatory process, pointing to a likely bacterial etiology exacerbated by immune or environmental factors.

Management and outcomes. To address the outbreak, a comprehensive treatment strategy was implemented. All pigs were administered amoxicillin via the drinking water as a first-line antimicrobial therapy. Pigs exhibiting clinical signs received additional intramuscular injections of long-acting penicillin combined with meloxicam to manage inflammation and discomfort. A fibrinolytic therapy was also attempted to address the extensive fibrinous adhesions observed in the necropsy findings; however, no follow-up evaluation was conducted to assess its efficacy.

An investigation was carried out into the farm of origin from which the piglets had been purchased. According to the supplier, no previous issues with polyserositis had been reported in their herd. However, it was noted that the source farm did not perform vaccination protocols for either sows or piglets, potentially contributing to the pigs' susceptibility to systemic bacterial infections during the growing phase.

Following the initiation of therapy, the clinical signs began to improve, and the mortality rate stabilized. While the weakest pigs succumbed to the disease, resulting in a total mortality of 128 animals, the remaining pigs showed gradual recovery. Despite the improved health of the surviving pigs, the outbreak had a significant impact on production performance. Growth rates and feed conversion ratios were severely affected in this batch, reflecting the lasting consequences of the disease.

Ultimately, the farmer was able to finish the remaining pigs and market them to a slaughterhouse, though the overall productivity and profitability of the batch were markedly reduced due to the losses and slowed growth. This case highlights the importance of robust vaccination protocols and rapid, targeted therapeutic interventions to mitigate the impacts of polyserositis outbreaks in swine production systems.

Discussion. The outbreak of severe polyserositis described in this report posed significant challenges despite the farm’s adherence to high biosecurity and hygiene standards. This section discusses the potential causes, broader implications, and comparisons with similar cases reported in the literature.

Possible causes. Polyserositis in pigs is often attributed to bacterial pathogens such as *Haemophilus parasuis* (the causative agent of Glässer’s disease), *Mycoplasma hyorhinis*, and *Streptococcus suis* (Cai et al 2005; Gottschalk et al 2010). These bacteria frequently act as secondary pathogens, capitalizing on stress or immunosuppression caused by environmental, nutritional, or management factors (Zimmerman et al 2019). In this case, the absence of a vaccination program at the source farm may have left the piglets

vulnerable to these pathogens, especially during the stress of transport and adaptation to the finishing unit. Stress is a well-documented predisposing factor for bacterial infections, as it weakens the immune system and disrupts the gut microbiome (Palzer et al 2015).

Additionally, coinfections with viruses such as porcine reproductive and respiratory syndrome virus (PRRSV) or swine influenza virus can exacerbate the severity of bacterial infections (Lowe et al 2005). Although no evidence of viral involvement was reported in this case, it remains a plausible contributing factor given the clinical presentation and rapid spread of the disease.

Impact on production. The outbreak had a profound impact on the farm's productivity. The total mortality of 128 pigs accounted for 16% of the batch, representing a substantial economic loss. Additionally, the surviving pigs exhibited reduced growth rates and poor feed conversion ratios, further compounding the economic consequences. This aligns with findings from other studies, which highlight the economic burden of polyserositis outbreaks in intensive swine operations (Aragon et al 2019; Noyes et al 1990).

Comparison with other cases. Outbreaks of polyserositis are well-documented in intensive swine production systems, with varying severity depending on pathogen virulence, host factors, and management conditions. For instance, *Haemophilus parasuis* outbreaks often present with fibrinous polyserositis, arthritis, and meningitis, with mortality rates ranging from 5% to 50% depending on the timing of intervention (Olvera et al 2009). In contrast, *Mycoplasma hyorhinis* typically affects younger pigs, with less severe systemic involvement (Thomson et al 2019).

The findings in this case, including extensive fibrinous adhesions and high mortality, are consistent with severe *H. parasuis* infections. However, the absence of confirmatory diagnostic results limits the ability to definitively identify the causative agent. Studies emphasize the importance of pathogen-specific diagnostics, such as PCR and serotyping, to guide targeted therapeutic and preventive measures (Petrocchi-Rilo et al 2021).

Conclusions. This case highlights the significant challenges posed by polyserositis in intensive swine production systems, even under high biosecurity and hygiene standards. The outbreak, which affected approximately 20% of the herd and resulted in the loss of 128 pigs, underscores the critical importance of early diagnosis, targeted therapeutic interventions, and preventive strategies.

The findings emphasize the need for robust vaccination programs at the source farm to enhance the resilience of piglets against systemic bacterial infections during the growing and finishing periods. Additionally, minimizing stress during transport and maintaining a high standard of biosecurity throughout the production chain are essential for preventing such outbreaks.

While the implemented treatment protocol, including amoxicillin, long-acting penicillin, and meloxicam, helped stabilize the situation and reduce further losses, the outbreak had a profound impact on the farm's productivity, with reduced growth rates and feed efficiency in the surviving pigs.

This case serves as a reminder of the multifactorial nature of polyserositis and the necessity for a proactive approach to health management in modern swine production. Future efforts should focus on enhancing diagnostic capabilities, improving preventive measures, and fostering collaboration between source and finishing farms to mitigate the impact of similar outbreaks.

Conflict of interest. The authors declare that there is no conflict of interest.

References

Aragon V., Segales J., Oliveira S., 2019 Glässer's disease. In: Zimmerman J. J., Karriker L. A., Ramirez A., Schwartz K. J., Stevenson G. W., Diseases of swine. 11. Ames: Wiley-Blackwell. 760–769 pp.

Cai X. W., Chen H. C., Blackall P. J., Yin Z. Y., Wang L., Liu Z. F., Jin M. L., 2005 Serological characterization of *Haemophilus parasuis* isolates from China. Veterinary Microbiology 111(3-4):231–236.
Gottschalk M., Xu J., Calzas C., Segura M., 2010 *Streptococcus suis*: a new emerging or an old neglected zoonotic pathogen? Future Microbiology 5(3):371-391.
Lowe J. F., Husmann R., Firkins L. D., Zuckermann F. A., Goldberg T. L., 2005 Correlation of cell-mediated immunity against porcine reproductive and respiratory syndrome virus with protection against reproductive failure in sows during outbreaks of porcine reproductive and respiratory syndrome in commercial herds. Journal of the American Veterinary Medical Association 226(10):1707–1711.
Macedo N., Gottschalk M., Strutzberg-Minder K., Van C. N., Zhang L., Zou G., Zhou R., Marostica T., Clavijo M. J., Tucker A., Aragon V., 2021 Molecular characterization of *Glaesserella parasuis* strains isolated from North America, Europe and Asia by serotyping PCR and LS-PCR. Veterinary Research 52:68. doi: 10.1186/s13567-021-00935-9.
Noyes E. P., Feeney D. A., Pijoan C., 1990 Comparison of the effect of pneumonia detected during lifetime with pneumonia detected at slaughter on growth in swine. Journal of the American Veterinary Medical Association 197:1025-1029.
Olvera A., Ballester M., Nofrarías M., Sibila M., Aragon V., 2009 Differences in phagocytosis susceptibility in *Haemophilus parasuis* strains. Veterinary Research 40(3):24. doi: 10.1051/vetres/2009007.
Palzer A., Haedke K., Heinritzi K., Zoels S., Ladinig A., Ritzmann M., 2015 Associations among *Haemophilus parasuis*, *Mycoplasma hyorhinis*, and porcine reproductive and respiratory syndrome virus infections in pigs with polyserositis. The Canadian Veterinary Journal 56(3):285-287.
Petrocchi-Rilo M., Martínez-Martínez S., Aguarón-Turrientes Á., Roca-Martínez E., García Iglesias M.-J., Pérez-Fernández E., González-Fernández A., Herencia-Lagunar E., Gutiérrez-Martín C.-B., 2021 Anatomical site, typing, virulence gene profiling, antimicrobial susceptibility and resistance genes of *Streptococcus suis* isolates recovered from pigs in Spain. *Antibiotics* 10(6):707. doi: 10.3390/antibiotics10060707.
Segura M., Zheng H., de Greeff A., Gao G. F., Grenier D., Jiang Y., Lu C., Maskell D., Oishi K., Okura M., Osawa R., Schultsz C., Schwerk C., Sekizaki T., Smith H., Srimanote P., Takamatsu D., Tang J., Tenenbaum T., Tharavichitkul P., Hoa N. T., Valentin-Weigand P., Wells J. M., Wertheim H., Zhu B., Gottschalk M., Xu J., 2014 Latest developments on *Streptococcus suis*: an emerging zoonotic pathogen: part 1. Future Microbiology 9(4):441-444.
Thomson J. R., Friendship R. M., 2019 Mycoplasmal diseases. Diseases of swine. 11th edition, Wiley-Blackwell. 1132 pp.
Willemse N., Howell K. J., Weinert L. A., Heuvelink A., Pannekoek Y., Wagenaar J. A., Smith H. E., van der Ende A., Schultsz C., 2016 An emerging zoonotic clone in the Netherlands provides clues to virulence and zoonotic potential of *Streptococcus suis*. Scientific Reports 6:28984. doi: 10.1038/srep28984.
Zimmerman J. J., Karriker L. A., Ramirez A., Schwartz K. J., Stevenson G. W., 2019 Diseases of swine. 11th edition. Wiley-Blackwell. 1132 pp.

Received: 11 November 2024. Accepted: 20 November 2024. Published online: 09 December 2024.
Authors:
Andrei Ungur, Department of Porcine Health Management, Faculty of Veterinary Medicine, University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca, Romania, e-mail: andrei.ungur@usamvcluj.ro

How to cite this article:
Ungur A., 2024 Polyserositis in intensive swine production: a case study of high morbidity and mortality. Porc Res 14(1):11-16.