

Feasibility of Home-Based Electromagnetic Navigation-Guided Nasojejunal Tube Placement in a High-Risk Bedridden Elderly: A Case Report

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Objective: To evaluate the feasibility and clinical outcomes of a nurse-performed, home-based electromagnetic navigation-guided nasojejunal tube placement in a high-risk bedridden elderly patient who was unable to be transported to hospital.

Methods: We present a case of an 89-year-old male with long-term bedridden status and high aspiration risk. A qualified nurse performed electromagnetic navigation-guided nasojejunal tube insertion in the patient's home environment. The procedure steps, nursing interventions, and short-term outcomes were documented.

Results: The tube was successfully placed in the upper jejunum under real-time electromagnetic guidance within 8 minutes. No complications such as tube displacement, blockage, or aspiration occurred during the 15-day follow-up. Family satisfaction was high.

Conclusion: This first reported case suggests that nurse-led, home-based electromagnetic navigation-guided nasojejunal tube placement may be a feasible and safe option for high-risk bedridden elderly patients who cannot be transported. Strict environmental assessment, operator expertise, and structured risk management are essential for success.

Keywords: electromagnetic navigation, nasojejunal tube, home-based care, aspiration risk, elderly, case report

Introduction

Long-term bedridden elderly patients often exhibit impaired swallowing and reduced gastric motility, placing them at high risk of aspiration during enteral nutrition support.^{1,2} Post-pyloric feeding is a key strategy to reduce aspiration risk.³ However, traditional bedside blind insertion of nasojejunal tubes is associated with variable success rates (30–80%) and often requires radiographic confirmation.^{4,5} While fluoroscopic, ultrasonographic, or endoscopic guidance improves accuracy, these methods typically necessitate hospital transfer, which may be impractical or hazardous for fragile, immobile patients.^{4–6}

Electromagnetic (EMN) navigation-guided tube placement has been increasingly used in hospital settings for precise and rapid tube positioning, with several studies confirming its efficacy and safety in critically ill patients.⁴ While ultrasound guidance is also radiation-free and has shown high success rates for post-pyloric tube placement; however, it has important limitations in the home setting. Ultrasound requires intermittent probe repositioning, can be hindered by bowel gas or obesity, and demands advanced operator skills for real-time interpretation. In contrast, EMN navigation provides continuous three-dimensional tracking of the tube tip along the entire insertion path, with a user-friendly interface that is more readily mastered by trained nurses. These features make EMN navigation particularly suitable for a home-based, nurse-led procedure. However, to the best of our knowledge, no previous study has reported the use of EMN navigation for nasojejunal tube placement in a community or home-based care environment.

In this case report, we describe the first known instance of a nurse-led, home-based EMN navigation-guided nasojejunal tube placement in a high-risk bedridden elderly patient who was unable to be transported to hospital. This single case suggests a possible shift in how advanced enteral access might be provided in community settings, with

potential implications for nursing practice and home healthcare innovation; however, further evidence is needed to confirm safety and generalizability beyond this patient.

Case Presentation

Clinical Profile and Background

An 89-year-old male with a history of multiple cerebral infarctions and hemorrhages, Parkinson's disease, and vascular dementia was admitted due to recurrent aspiration pneumonia and type II respiratory failure, necessitating invasive mechanical ventilation during a prior hospitalization in March 2023. The patient was bedridden for 15 years with severe dysphagia (Grade V on the Water Swallow Test), bilateral lower limb muscle strength graded 2–3, and left-sided limb strength 3–4. He presented with chronic malnutrition, indicated by a body weight of 50 kg and a body mass index (BMI) of 17.3 kg/m^2 , corroborated by persistent hypoalbuminemia (eg, 30.5 g/L upon readmission in January 2025). The patient had a documented history of failed blind bedside nasojejunal tube placement during a previous hospital stay.

Rationale for Home-Based Intervention

Following the most recent hospitalization for respiratory failure and pneumonia (January 2025), the patient required postpyloric feeding for long-term nutritional support and aspiration prevention. However, due to his critical and unstable condition including a history of ventilator dependence, active lower limb deep vein thrombosis, electrolyte imbalances, and the high physical and psychological stress associated with medical transport the family explicitly declined interhospital transfer. After a comprehensive multidisciplinary assessment of risks and benefits, informed consent was obtained for a home-based, electromagnetic navigation (EMN)-guided nasojejunal tube placement.

Procedure and Monitoring

The procedure was performed in the patient's home bedroom by a nurse credentialed in EMN-guided tube placement and maintenance. The home environment was pre-assessed, confirming the absence of strong electromagnetic interference sources within an 8 m^2 area around the patient's bed. "Strong electromagnetic interference sources" were defined as active devices that emit variable electromagnetic fields, including large electric motors (eg, refrigerators, washing machines, air conditioners), wireless chargers, induction cooktops, and radiofrequency transmitters. Static metal objects (eg, the metal bed frame, furniture, or wall reinforcements) do not typically interfere with the EMN navigation system, as verified by the device's built-in field quality indicator. The working area was kept clear of any such active devices during the procedure.

Environmental and equipment layout: The patient's bedroom measured approximately 8 m^2 . The patient's bed (standard metal-frame medical bed) was positioned with at least 1 m of clearance on both sides. The portable EMN console (approx. $40 \text{ cm} \times 30 \text{ cm} \times 10 \text{ cm}$) was placed on a bedside table at the operator's eye level. The electromagnetic field generator was placed on the bed, under the patient's right lower abdomen, secured with a non-metallic strap. A portable pulse oximeter was attached to the patient's right index finger, with the display placed within the operator's direct line of sight. A portable oxygen cylinder (2 L/min capacity) and a suction device were positioned at the bedside, ready for emergency use. No active electromagnetic interference sources (eg, wireless chargers, induction cooktops, large electric motors) were present within the 8 m^2 working area, as confirmed by the device's built-in field quality indicator.

- (1) Pre-procedure: The patient fasted for 6 hours and received 10 mg of metoclopramide intramuscularly 30 minutes prior to promoting gastric motility.⁷
- (2) Intra-procedure: With the patient positioned at 30° head elevation, the tube was placed under real-time EMN guidance. Continuous monitoring of peripheral oxygen saturation (SpO_2) and heart rate was maintained using a portable pulse oximeter. A portable oxygen source was available on standby.

- (3) Technical Details: The catheter tip trajectory was visualized in real-time on the navigation screen, confirming passage through the esophagus, along the greater curvature of the stomach (characteristic “J” curve), and through the pylorus (confirmed by a distinct spatial “C” curve change upon passage).^{8,9} The final tip position was confirmed in the upper jejunum based on the length of insertion and the characteristic anatomical path visualized upon guidewire retraction.
- (4) Post-procedure: Tube patency was immediately confirmed by the easy injection of 20 mL of normal saline.^{10,11}

Results

The following primary and secondary outcomes were documented during and after the home-based procedure.

Primary Outcome: Procedural Efficacy and Safety

The nasojejunum tube was successfully placed on the first attempt. The total procedural time from insertion initiation to final position confirmation was 8 minutes.

Safety was rigorously documented: Throughout the procedure, the patient’s SpO₂ remained stable between 94% and 96% (on room air), with no episodes of desaturation, coughing, or signs of respiratory distress. No epistaxis, mucosal injury, or hemodynamic instability (eg, significant arrhythmia or blood pressure fluctuation) was observed. Epistaxis and mucosal injury are common risks during blind nasojejunum tube insertion due to potential trauma, while hemodynamic instability may occur during tube manipulation in frail elderly patients with cardiovascular comorbidities. The absence of these expected complications supports the atraumatic and hemodynamically stable nature of EMN navigation-guided placement in the home setting.

Secondary Outcomes: Short-Term Tube Function and Complications

The patient tolerated the initiation of standardized enteral nutrition well post-placement. During a structured 15-day follow-up period: (1) Tube Stability: The external fixation mark remained unchanged, indicating no clinical evidence of tube migration or displacement. (2) Tube Patency: No episodes of tube occlusion occurred. Regular water flushes (20 mL every 4 hours) were performed without resistance. (3) Complication Surveillance: There were no clinical signs of aspiration (eg, new-onset cough, fever, or worsening respiratory status), feeding intolerance (eg, significant diarrhea or abdominal distension), or local infection at the insertion site. The 15-day follow-up period was selected as a pragmatic short-term window to capture early complications (tube migration, occlusion, aspiration, feeding intolerance) while the patient was under intensive home nursing observation. This timeframe is consistent with prior studies reporting early outcomes of post-pyloric feeding tubes.^{12,13} (4) Nutritional Access: The tube provided reliable access for continuous enteral feeding, addressing the patient’s baseline malnutrition without the need for parenteral support. Regarding the long-term plan: after the initial 15 days, the patient continued enteral nutrition via the same tube under monthly home nursing follow-up, with scheduled elective tube replacement every 4–6 weeks per institutional protocol.

Discussion

This case report presents the first systematic account of a nurse-led, home-based EMN-guided nasojejunum tube placement in a high-risk, bedridden elderly patient with multiple comorbidities and a history of aspiration. The successful outcome in this single case suggests that, for this particular medically complex patient who is not a candidate for transport, performing the procedure in a home setting may be feasible and relatively safe; however, potential risks remain, and these findings should not be generalized to other similar cases. Success hinges on stringent patient selection, thorough pre-procedural planning, operator expertise, and real-time imaging confirmation. This case suggests the potential of this model as a safe and efficient alternative to conventional in-hospital tube placement for a specific patient population.

Technical Advantages: Precision, Safety, and Home Compatibility

Compared to the traditional blind insertion method commonly used at home which has a highly variable success rate (30–80%) and requires subsequent radiographic confirmation, the core strength of EMN technology lies in its real-time intraluminal navigation.^{14,15} In this case, the operator visualized the characteristic “J” and “C” loops on the monitor, allowing precise real-time tracking of the catheter tip through the pylorus.^{8,16} Such visual guidance fundamentally overcomes the limitations of blind

insertion at home, elevating the first-attempt success rate to a predictable level and providing immediate confidence to initiate enteral nutrition.

While ultrasound guidance is a valuable radiation-free alternative for post-pyloric tube placement, EMN navigation offers several distinct advantages in the home setting. First, EMN provides continuous three-dimensional tracking of the tube tip along the entire insertion path, whereas ultrasound requires intermittent probe repositioning and may lose visualization when the tip passes beyond the stomach or is obscured by bowel gas. Second, ultrasound interpretation is highly operator-dependent, requiring advanced skills in real-time image acquisition and anatomical recognition. EMN navigation presents a more standardized, user-friendly interface, making it more readily adoptable by trained nurses in community settings. Third, EMN is less affected by patient body habitus (eg, obesity) or abdominal distension. In this case, where a single nurse performed the procedure in a home bedroom without immediate physician backup, the continuous and intuitive guidance of EMN was preferred to ensure both safety and first-attempt success.

Furthermore, this approach achieves dual-risk mitigation. First, it completely avoids the cardiopulmonary risks and physiological stress associated with transporting fragile patients. Second, as a radiation-free technique,^{17,18} EMN eliminates concerns about radiation exposure for the patient, family members, and the operator, fully aligning with the safety and ethical expectations of a home environment. The portability of the equipment (including a compact console and field generator) and its minimal spatial requirement (approximately 1 m²) underscore its excellent compatibility with home use, effectively extending tertiary-hospital-grade precision to community and home care settings.^{19,20} The system's tolerance to static metal objects (eg, standard bed frames) and its built-in field interference detection further support its safe deployment in typical home bedrooms.

Evolving Nursing Role: From Performer to Advanced Practitioner

The success of this case highlights the pivotal role of specially trained nurses who possess a solid understanding of anatomy and the ability to interpret navigation images. The operator was required not only to execute the technical steps proficiently but also to make independent judgments and adjustments based on real-time imaging (eg, recognizing and correcting gastric coiling). This represents an expansion of the nursing role from a performer of routine care to a safe implementer and decision-maker for advanced invasive procedures in the home setting. To operationalize this role in community health settings, we propose several requirements. First, nurse credentialing should include didactic training on EMN navigation principles, hands-on simulation with at least 10 supervised placements, and successful completion of a competency examination. Second, a structured multidisciplinary support framework is essential: this includes remote physician backup (available by telemedicine or phone), pre-established transfer protocols to a nearby hospital for emergencies, and routine data review by a hospital-based enteral access team. Third, regular refresher training (eg, every 6–12 months) and complication tracking are recommended to maintain safety standards. Establishing standardized nurse credentialing and training protocols is fundamental to disseminating this technology and ensuring its safety.

Limitations, Clinical Indications, and Future Directions

As a single-case report, this study has inherent limitations. Its primary constraint is the lack of generalizability; while successful, the outcomes cannot be extrapolated to broader patient populations or diverse home environments. More critically, the reliance on EMN trajectory alone for final position confirmation without the gold standard of radiographic imaging introduces a potential diagnostic uncertainty regarding tube tip location in cases of anatomical variation. Additionally, the legal, ethical, and emergency support frameworks for performing such invasive procedures at home require clearer standardization and policy support.

Based on this experience, preliminary clinical indications for home-based EMN tube placement may include: (1) patients with a clear need for post-pyloric feeding (eg, high aspiration risk); (2) those who are non-transportable due to critical illness or high transfer risk; and (3) homes meeting basic operational and safety criteria. Conversely, key contraindications should be considered, such as active upper GI bleeding, severe coagulopathy, significant anatomical alterations, or an unsuitable home environment.

Future work must address these gaps through two parallel strands. Firstly, technical validation: Implementing a dual-verification model that combines EMN guidance with portable bedside ultrasound could mitigate the confirmation challenge in the home setting, enhancing safety without relying on radiation. Secondly, systematic evaluation and protocol development:

There is an urgent need for multi-center, large-scale studies to establish robust evidence on success rates, complications, and cost-effectiveness. These findings should directly inform the creation of standardized operational protocols, explicit contraindications, and structured emergency response plans for advanced home care procedures, paving the way for evidence-based guidelines or expert consensus.

Policy and Managerial Implications

This case report offers several actionable insights for healthcare policy and home care management. First, reimbursement and regulatory frameworks should be updated to recognize nurse-led advanced procedures performed in home settings. Currently, most payment systems cover electromagnetic navigation-guided tube placement only in hospitals. Policymakers may consider creating specific billing codes or bundled home care packages that include real-time navigation technology, thereby incentivizing community-based alternatives for non-transportable patients. Second, standardized training and credentialing are essential for safe dissemination. Health authorities and professional nursing organizations should develop competency--based curricula for EMN navigation, including simulation requirements, supervised placements, and periodic recertification. This case supports the feasibility of a “train-the-trainer” model to build regional expertise. Third, home care agencies should establish structured safety protocols that include: pre-procedural environmental assessment (defining and testing for electromagnetic interference sources), real-time remote physician backup (via telemedicine), and pre-defined emergency transfer pathways to nearby hospitals. Managers should also ensure that portable emergency equipment (eg, oxygen, suction, resuscitation kit) is available on site. Fourth, integration into community health service packages could be piloted in regions with high concentrations of bedridden elderly patients. Bundling EMN-guided tube placement with routine home nursing visits may reduce hospital readmissions for aspiration pneumonia and malnutrition, potentially generating net cost savings. These implications, while derived from a single case, provide a practical roadmap for scaling this innovation. Future research should evaluate the cost-effectiveness and patient-reported outcomes of policy implementation.

Conclusion

In conclusion, when conducted by a qualified nurse following rigorous assessment of the patient’s condition, home environment, and emergency preparedness, EMN-guided nasojejunal tube placement may offer a precise and safe option for enteral access in high-risk, non-transportable bedridden elderly patients. This case provides preliminary evidence for the innovative application of advanced technology in home care. However, further large-scale studies are needed to confirm the safety, feasibility, and generalizability of this approach. By optimizing technical combinations and generating robust, standardized evidence through further research, this model has the potential to become a significant advanced nursing practice within continuity of care, ultimately improving the quality and accessibility of home-based medical services. Realizing this potential will require supportive policy changes, including reimbursement reform, standardized credentialing, and integration of navigation technology into community health service packages.

Data Sharing Statement

The experimental data used to support the findings of this study are available from the corresponding author upon request.

Ethics Approval and Consent to Participate

This case report was conducted in accordance with the Declaration of Helsinki. The institutional ethics committee of Zhongnan Hospital of Wuhan University reviewed and approved the study protocol, including the publication of the patient’s clinical data (approval No. 2026193K). Written informed consent was obtained from the patient’s legally authorized representative (healthcare proxy) for both the home-based electromagnetic navigation-guided procedure and the subsequent publication of this case report, including any potentially identifiable clinical details and images. The patient was unable to provide consent independently due to vascular dementia.

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Disclosure

The authors declared that they have no conflicts of interest regarding this work.

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