Rehabilitation Practice and Science

Volume 49
Issue 2 *Taiwan Journal of Physical Medicine and Rehabilitation (TJPMR)*

Article 1

12-31-2021

Poststroke Swallowing Rehabilitation and Recent Development

Shu-Fen Sun

Ping-Hsin Chang

Chien-Wei Hsu

I-Hsiu Liou

Recommended Citation

Sun, Shu-Fen; Chang, Ping-Hsin; Hsu, Chien-Wei; and Liou, I-Hsiu (2021) "Poststroke Swallowing Rehabilitation and Recent Development," *Rehabilitation Practice and Science*: Vol. 49: Iss. 2, Article 1.
DOI: https://doi.org/10.6315/TJPMR.202112_49(2).0001
Available at: https://rps.researchcommons.org/journal/vol49/iss2/1

綜說

腦中風後吞嚥障礙的復健治療與近期發展

孫淑芬[1,2] 張炳鑫[1] 許健威[2,3] 劉亦修[1]

高雄榮民總醫院 復健部[1] 國立陽明大學 醫學系[2] 高雄榮民總醫院 內科部[3]

吞嚥障礙是腦中風常見的併發症，和吸入、營養不良、脱水、失能有關，且會增加肺炎甚至死亡的風險。早期診斷及治療吞嚥障礙的病人不但可減少併發症，也可減少住院日數及總醫療支出。

腦中風後口咽部吞嚥障礙有相當多樣性的吞嚥異常型態，症狀臨床不易診斷，腦中風病人在住院及以口進食前都應儘早接受吞嚥篩檢，未通過篩檢或有吞嚥風險的病人，需由語言治療師(或適當的專業人員)進行專業臨床評估，必要時需安排吞嚥儀器檢查，例如透視螢光吞嚥檢查或光纖內視鏡吞嚥檢查，以判定吞嚥障礙嚴重程度，了解吞嚥的生理異常，並引導治療的方向。

腦中風後口咽部吞嚥障礙有許多的治療方法，包括代償策略與復健策略，有許多有潛力的治療方法漸出現，包括神經電刺激、用藥及加強吞嚥肌力的儀器等。建立多專業吞嚥團隊整合介入照護，可有效減少急性中風後肺炎的發生。雖然吞嚥復健是有效的，但腦中風後吞嚥障礙的處理仍屬被忽略的研究領域，未來仍需更多研究來找出最適宜的處置，包括診斷、評估及治療方法。(台灣復健醫誌 2021；49(2)：129 - 145)

關鍵詞：吞嚥障礙(dysphagia)，電刺激(electrical stimulation)，腦中風(stroke)，中風相關的肺炎(stroke-associated pneumonia)，吞嚥復健(swallowing rehabilitation)

前　言

急性中風後約有28-65%的患者會有不同嚴重程度的吞嚥障礙，[1-4]吞嚥障礙會使腦中風患者容易發生營養不良、脫水、社會退縮、影響生活品質，嚴重者易發生吸入性肺炎，導致住院日數、住院花費、再住院率增加，出院回家的比率減少，死亡率增加。[5-7]台灣的研究指出中風發病一年內，有吞嚥障礙的病人吸入性肺炎的機率是沒有吞嚥障礙病人的 4.7 倍，且五年內死亡率顯著高於沒有吞嚥困難者。[8]急性中風後早期偵測及治療吞嚥障礙可減少吸入性肺炎風險、住院日數及整體醫療保健支出，[9]雖然近年急性中風後的處置有許多新的進展，但中風後吞嚥障礙最適當的診斷和治療目前尚無定論。本文回顧國內外研究，探討腦中風後吞嚥障礙患者的處置，包括篩檢、評估、復健治療、用藥及近期發展。

流行病學

吞嚥障礙是腦中風後常見的問題，在急性中風 3 天內約有 42-67%的患者會發生吞嚥障礙，[3]而在中風 2 週後，約 90%的病人可以恢復到安全吞嚥[7,9]，有研究指出中風後 6 個月時有 11-13%患者有吞嚥問題，[2] Mann 等人追蹤急性中風住院病人發現在6個月時以電視螢光吞嚥攝影(VFSS)檢查發現有將近一半的患者仍有不同程度的吞嚥異常，[10]造成這些不同的數值差異，和中風後評估時間、評估方式、吞嚥困難的定義及嚴重度不同有關。[1-4,10]

有吞嚥障礙的病人，不一定會有主觀的症狀。無徵狀的吸入(silent aspiration)指的是食物誤入眞聲帶之

投稿日期：110 年 4 月 29 日　修改日期：110 年 5 月 26 日　接受日期：110 年 6 月 9 日

通訊作者：孫淑芬醫師，高雄榮民總醫院復健部，高雄市左營區大中一路 386 號。

電話：(07) 3422121 轉 4210　E-mail：sfsun.tw@yahoo.com.tw

doi: 10.6315/TJPMR.202112_49(2).0001

下，但沒有咳嗽或其他外顯的徵象，中風患者估計至少約有 25-28%的患者會有無徵狀的吸入現象，[11,12]而中風後有吞嚥障礙者，肺炎的死亡率是沒有吞嚥障礙者的 3 倍，[13]因此早期吞嚥篩檢，早期找出有吸入性肺炎風險的病人是很重要的。[14]無徵狀的吸入現象和咽喉感覺缺失或因長期慢性吸入後造成咽喉漸漸減敏感(desensitization)有關，[15] 幾乎所有中風後有吞嚥障礙的病人都會有單側或兩側咽喉感覺缺失，而咽喉感覺缺失的嚴重度和中風患者吸入的風險有直接相關。[16]

值得提醒的是現代高齡化的社會，吞嚥障礙是評估老年症候群重要的健康議題，大於 65 歲的高齡長者約 13%有吞嚥困難。[17,18]因此評估年長腦中風併吞嚥障礙的病患時，年紀大導致的吞嚥退化(presbyphagia)也是該考量的，另外在住院期間因長時間置放鼻胃管無法由口進食或臥床導致肌肉廢用性萎縮或功能減退，也會對吞嚥功能有不良的影響。[19]

腦中風患者吞嚥困難的臨床表徵和病理機轉

正常的吞嚥可分爲四個時期，即口腔準備期、口腔傳送期、咽部期及食道期，吞嚥是一個很複雜需感覺及運動整合的過程，由腦幹到皮層下和皮層大腦結構的廣泛雙邊神經網絡來介導，[20]過去的研究確定了控制吞嚥的大腦網絡，包括體感覺皮質區(somatosensory cortex)、運動輔助區(supplementary motor area)、額頂島蓋(frontoparietal operculum)、前額葉皮質(prefrontal cortex)和下額葉皮層、扣帶皮層(cingulate cortex)，腦島皮質(insular cortex)、丘腦、基底核、小腦、橋腦和延髓。[21,22]吞嚥控制的中樞在腦幹，發動中樞(central swallowing pattern generator; CPG)位於延髓的頭端(rostral medulla)，[23]腦幹從口咽喉黏膜、肌肉及大腦皮層等統合接收各種輸入，由腦幹發出最終的吞嚥命令，吞嚥啓動後經由大腦皮質及皮質下的廣泛活化產生複雜序列性的吞嚥動作和感覺傳輸，[24] 以執行及時和精確的吞嚥。

腦中風造成的吞嚥障礙較常影響口腔及咽喉期，因受損部位不同(例如腦幹、皮質或皮質下結構)而有不同的嚴重度及表現，[25]研究指出前循環的腦梗塞較易有口腔期的功能異常;而後循環的梗塞及白質的疾病，較易有咽部期的異常，後循環腦梗塞者也有較高比率的滲入(penetration)及吸入發生，[26]而在右大腦半球、天幕下(infratentorial)及白質的病變，會有較嚴重的吞嚥障礙。[25,27-29]近年功能性磁振造影(fMRI)及腦磁圖(MEG)等研究顯示大腦皮質對吞嚥功能的控制有重要的影響，雖然有些研究分析腦病變位置和相對應的吞嚥表現，但都還在研究早期，且都還未有定論。[25,30-32]研究顯示中風後吞嚥功能的進步和健側大腦的皮質整合(reorganization)及神經可塑性(neuroplasticity)有關。[29-32]

腦中風患者吞嚥障礙的篩檢和評估

吞嚥篩檢是以快速的方式來找出吞嚥障礙高危險群的病人，以視情況儘早安排進一步的吞嚥評估，早期吞嚥篩檢可減少急性中風後肺炎的風險，[33-36]研究顯示每延後篩檢一天會增加 1%肺炎的風險，[35]吞嚥篩檢不通過者，和不良預後及一年的死亡率相關。[37]中風後有執行吞嚥篩檢的機構比沒有篩檢者，肺炎的發生率明顯較低，[33]因此所有急性中風患者在進食或喝水前皆需經過語言治療師，或受過訓練的醫護或健康照護專門人員進行篩檢。[38]

目前有許多不同的吞嚥篩檢方法，[39-52]評估項目包括認知、語言能力、臉部對稱性及口腔動作評估、吃東西時有無嗆咳、聲音有無變化、吞口水及咳嗽的能力，[53]有些測試加入單次吞水、逐次吞不同水量或計時的吞水測試，來觀察嗆咳風險[43-46]，例如 3 盎司(約 90ml)喝水測試對中風病患偵測有無吸入，有很好的敏感性(sensitivity)，方法是讓病人連續喝 3 盎司的水，觀察一分鐘判斷是否有咳嗽或聲音改變，若沒通過則表示不適合由口進食液體。[43,44]然而很多中風及高齡患者無法連續或喝大量液體，所以有很多不同版本的改良式喝水測試(例如喝 10 ml-150 ml 不等)，[43-46]喝水測試(modified water swallowing test, MWST)是以吞嚥 3ml 冷水篩檢病患是否有無法吞嚥、呼吸困難、嗆咳等症狀出現，[46] 此篩檢方式也適用於重症患者。系統性回顧文章指出喝水測試若僅喝一口 1 至 5ml 的水觀察有無嗆咳或聲音改變來篩檢，敏感度爲 71%；若逐口增量喝水的方式篩檢，敏感性爲 86%；而連續喝下 90 至 100ml，則敏感性爲 91%，以上三類篩檢方式的特異性(specificity)分別爲 90%、65%及 53%，[43]雖然喝水測試有足夠的敏感性來篩檢吞嚥障礙，目前最適宜的喝水量仍不明。

國內各醫院因語言治療師人數偏少，因此目前多由護理人員使用簡易且迅速的吞嚥篩檢作爲腦中風急性期方便有效的評估工具。標準吞嚥功能評估(Standardized Swallowing Assessment, SSA)是適合臨床護理人員之吞嚥篩檢工具，SSA 包括三個部分，第一部分是臨床檢查(患者警覺性、保持軀幹直立與頭部控制的能力) ，第二部分評估自主咳嗽、口水控制、舔上下唇的能力及呼吸是否平順與嗓音音質。[48]若患者在上述一二部分任何項目異常，則篩檢不通過，需照會語言治療師；若前述均通過，則給予三次 5ml 的水

測試；若無異常，再給予約 60ml 的水測試，所有項目均通過者則可在監督下進食，[48] SSA 具良好的敏感度(97%)與特異性(90%)。另外也有測試多種食物質地的吞嚥篩檢方法，例如容積－黏稠度吞嚥測試(volume-viscosity swallow test, V-VST)爲安全快速且適用於多種診斷的吞嚥篩檢工具，篩檢過程僅需 5-10 分鐘。[49,50] 此測試使用三種體積(5, 10, 20ml)及三種質地(花蜜狀、稀溶液、布丁狀) 加上血氧飽和度測試來評估患者是否可安全有效的吞嚥。V-VST 篩檢吸入的敏感性良好(88.2%)，特異性爲 71.4%，若吞嚥過程觀察到有雙唇閉合不佳、分次吞嚥(piecemeal deglutition)、口咽部殘留則表示吞嚥效率不佳；若觀察到吞嚥後聲音品質改變、咳嗽、血氧飽和度下降 3%以上則表示無法安全吞嚥。

美國心臟學會和美國中風學會都把吞嚥篩檢列在中風早期治療指引，[54,55]雖然此兩個學會支持使用多倫多床邊吞嚥測試(Toronto bedside swallowing test)和 3 盎司喝水測試，[56,57]但目前對最適宜的吞嚥篩檢工具及最佳篩檢時機並無定論。歐美等國腦中風的治療指引建議病人應於入院後 24 小時內及進食前由訓練過的專業人員完成吞嚥篩檢，也有指引建議腦中風患者在入院後 4 小時內及進食前應完成吞嚥篩檢。[54,58-60]

近年自主吞嚥的頻率可應用於急性中風後有無吞嚥障礙的篩檢[61,62]，中風後自主吞嚥頻率減少和口水中的 P 物質(substance P)減少有關，而 P 物質可控制吞嚥反射，[62]研究顯示若患者每分鐘吞嚥次數≤0.4 次，可確認其有吞嚥障礙，且自主吞嚥頻率減少和吞嚥困難的嚴重度相關，[63]反覆性唾液吞嚥試驗法(repetitive saliva swallowing test, RSST)是在 30 秒內請病人吞口水，次數愈多次愈好。如果 30 秒內的吞嚥次數小於 3 次，則需安排進一步檢查。[64]最新研究指出中風後住院 3 天內，若在 2 分鐘內沒有自主吞嚥出現，可預估在一週時需要鼻胃管灌食。[65]

對於有氣切的病人可以使用伊凡氏藍染(Evan's blue dye)測試或改良的伊凡氏藍染測試來做吞嚥篩檢。[66,67]方法是在評估氣切套管患者的吞嚥時，會在患者的食物加入 3-5ml 稀釋之藍色食用色素，由口吞入後觀察與抽吸氣切口評估是否出現藍染試劑，連續三次陰性則可少量由液態食物開始嘗試由口進食，研究顯示改良的伊凡氏藍染測試方法，靈敏度差異很大（38-95％），但有高特異性(79-100％)，顯示改良的伊凡氏藍染測試方法可以正確識別出沒有口咽部吸入的患者。[67]

腦中風吞嚥障礙之評估 (Assessment)

透過篩檢只能得知病人是否有吞嚥障礙、能否由口進食，並無法了解造成此障礙的生理異常原因，因此對於篩檢出有吞嚥障礙風險者需進一步接受詳細評估，再視需要安排儀器檢查(例如安排螢光吞嚥攝影或纖維內視鏡來檢查)才可進一步幫助判定吞嚥生理的異常(例如舌頭無力、喉頭上抬不佳、氣道保護不良、食團推進無力、咽部肌肉無力或上食道括約肌無法放鬆等問題)。

吞嚥障礙的診斷需靠臨床吞嚥評估，或使用儀器評估。

臨床吞嚥評估(clinical bedside assessment)由語言治療師(或訓練過的醫療專業人員)執行，先詳細病史詢問及理學檢查後，再給予不同質地的食物與液體來評估吞嚥功能，臨床吞嚥評估後需給予飲食建議及判斷是否需使用吞嚥手法等。然而臨床吞嚥評估無法正確評估病人咽部期的狀況，有 25-28％的中風病人會有無徵狀的吸入，[11,12]有鑒於此常需視需要搭配儀器評估來確認病患是否有咽部殘留及誤吸等現象。

儀器評估包括透視螢光吞嚥檢查(videofluoroscopic swallowing study, VFSS)、光纖內視鏡吞嚥評估(fiberoptic endoscopic evaluation of swallowing, FEES)、超音波、吞嚥閃爍顯像(scintigraph)等，近年高解析度食道壓力檢測也被使用來解析吞嚥過程中咽喉到食道的壓力變化及檢查環咽肌的壓力是否異常，[68]最常見的兩種儀器評估是 VFSS 與 FEES。

VFSS 又稱爲改良式鋇劑吞嚥錄影檢查(modified barium swallow study, MBS)，利用含有鋇劑的不同質地食物來評估吞嚥的解剖生理及是否出現異常，包括舌頭動作型態、喉頭上抬及會厭後傾是否正常、有無鼻咽逆流、喉前庭滲入(laryngeal vestibular penetration)、誤吸的時間點(在吞嚥前、中或後)、誤吸的量及誤吸時是否有咳嗽反應、吞嚥後是否有殘留、殘留部位及殘留量等，藉此得知造成殘留及誤吸的吞嚥生理異常及吞嚥障礙的嚴重度，並可評估吞不同質地食物的能力與吞嚥呼吸間的協調性，也可評估代償性手法對吞嚥與呼吸道保護的效果等。VFSS 過去一直被認爲是評估吞嚥的黃金標準檢查，[69]研究顯示在急性中風 7 天內早期使用 VFSS 有助決定最適當的飲食，[70]但 VFSS 缺點爲設備昂貴且耗費人力及時間，檢查時病人暴露於輻射線，因此不宜對病人密集的追蹤，吞服的是鋇劑而不是眞正的食物，可能引起患者反感而拒絕吞服，病人若意識不清或無法配合指令則需暫緩實施。

FEES 是經鼻放入軟質內視鏡觀察咽喉腔的解剖構造及生理功能並評估吞口水及沾有染料的不同質地食物或液體的能力，藉此判斷吸入風險並引導治療，

[71-73]若檢查包含使用空氣脈衝(air pulse)的設備測試上喉神經(superior laryngeal nerve)等黏膜的感覺，則稱爲fiberoptic endoscopic evaluation of swallowing with sensory testing(簡稱 FEESST)。[74]FEES 因爲安全可靠、攜帶方便、可重複施測且可在診間或病床邊施測、吞服的是眞正的食物而非鋇劑、無輻射線且設備比 VFSS 便宜、成本效益高，還可讓患者直接看到吞嚥結果並給予回饋，進行吞嚥障礙的生物回饋訓練(biofeedback training)等，現在有愈來愈多人使用 FEES 來評估病人，尤其是急性中風的時期，[75]吞嚥內視鏡檢查最大的缺點是在吞嚥的瞬間內視鏡的視野會泛白(whiteout)，因此無法完整的看到吞嚥的全程，只能利用吞嚥前與吞嚥後的狀態來推估吞嚥障礙發生的原因或誤吸的時刻。近年 VFSS 和 FEES 都被視爲吞嚥評估的黃金標準，[76]兩者相輔相成，有研究顯示 FEES 比 VFSS 在偵測吸入及咽喉殘留物(residue)時有更好的敏感性。[77]

腦中風吞嚥障礙的治療

依據吞嚥評估的結果，爲病人擬定適當的治療，目的是減少吸入或咽部的殘留、提供充足的水分和營養，達到安全有效的吞嚥，建立口腔進食的能力。治療策略可以分爲代償策略與復健策略，代償策略可以藉由改變咽喉的尺寸、改變食團流向及增加食團的推動壓力，立即達到安全有效的吞嚥，但代償策略只有短期效果，不能改善吞嚥生理，也不能促進吞嚥的神經整合進步；而復健策略則藉由口腔與咽部運動、感覺刺激及神經肌肉電刺激等方法，來改善吞嚥的力量、速度、時間或協調度等，復健策略可以持續性的改善吞嚥生理，促進神經整合進步，達到長期的效果。

依患者狀況，代償與復健策略可以單獨使用，但大多會兩種並用。而有些復健策略例如吞嚥手法(swallow maneuvers)中的孟德爾森吞嚥法、上聲門吞嚥法、超上聲門吞嚥法及用力吞嚥法等，在進食時間使用有助立即改善吞嚥功能，所以同時也具有代償的效果。

臨床可運用的代償策略有很多，簡述如下。

(一) 改變進食姿勢

改變病患頭部或身體的姿勢可有效幫助 75 至 80%的吞嚥障礙病患去除吸入或嗆入現象，方法包括：

(1) 下巴內縮(chin tuck)－吞嚥時維持低頭使下巴向胸部靠近的姿勢，可縮短舌根及會厭到後咽壁的距離、縮小呼吸道入口、減少食團在會厭谿殘留、增加喉部前庭(laryngeal vestibule)關閉的時間和增加食團的推動力，[78-80]適用於因吞嚥啓動延遲而導致呼吸道保護不足者，若口舌控制不足、喉部上抬不足或喉部閉合不足導致吞嚥時發生吸入現象的患者也可使用。研究顯示某些殘渣堆積在梨狀竇的患者，做下巴內縮時可能因吞嚥時下咽部縮短，反而使殘渣溢流到喉部造成嗆入或吸入。[81]有些神經性吞嚥障礙病患使用下巴內縮法並無法減少吸入、嗆入，因此在使用下巴內縮法或其他代償策略前最好先使用儀器評估來確認這些代償策略的效果。[82,83]

(2) 將頭傾向健側(head tilt)－吞嚥時請患者將耳朵向肩膀靠近，利用重力讓食物通過控制能力較好的健側，傾頭可以使同側的咽部壓力增大，[84]使食團更容易通過，適用於單側口腔與咽腔無力或麻痺的患者。

(3) 轉頭(head rotation)向患側(指較無力的咽喉側)－可使患側的吞嚥通道變窄或關閉，使食團通過功能較好的咽側，[85]轉頭姿勢可以使對側環咽肌的壓力變小並延長環咽肌開啓時間，使食團更容易通過，適用於單側咽喉或聲帶無力、環咽肌功能異常者。[86]

(4) 躺下(supine)或斜躺(side lying)－某些嚴重患者在平躺或斜躺時可利用重力讓食物通過功能較好的咽側而減少吸入嗆入現象，平躺時一般需用枕頭將頭部抬高 30 度。[87]但於進食後最好維持坐立姿勢以避免胃食道逆流及吸入。[88]

(二) 改變食物濃稠度、質地、進食的量與速度

食物的質地應對應造成吞嚥障礙的潛在生理因素來做調整，例如對於某些舌頭功能異常、舌根部後縮不足、咽壁收縮不足或環咽肌放鬆不足的患者，適合較稀的食物或液體；但某些吞嚥反射延遲或口舌控制不良在吞嚥前就有氣道吸入的患者，較適合軟滑流速慢或增稠的液體或食物。[89]一般而言，食物的黏著性若增加，會增加咽部的殘留；食物的內聚性若增加，可減少肺部吸入及口腔殘留；液體的黏稠度越高，越不會有嗆咳或肺部吸入，但可能會有較多的會厭谿或咽部殘留。個別化的調整食物質地、進食的量與速度，有助改善吞嚥安全性，減少嗆入、吸入或咽部的殘留。

調整液體黏稠度的方法最簡便，只要加入市售的增稠劑即可，研究顯示增稠劑可能會改變食物的味道，在常見的液體中(例如咖啡、牛奶、蘋

果汁或柳橙汁)中加入澱粉類或黃原糖膠類(gum-based)增稠劑，食物的味道會被抑制[90]，這有助解釋患者對於稠狀液體的反感。因此對於使用增稠劑的患者需定期追蹤是否口服攝取量及營養不足，對於不喜歡添加增稠劑的患者，臨床也可嘗試教導用不同的增稠方法，例如太白粉、地瓜粉、蓮藕粉等，不僅增加風味，也提高熱量的攝取。

有關食物的質地分類，美國、日本等國家或團體制定了一些不同的分級標準，可以幫助病患日常飲食的製備，近年國際吞嚥困難飲食標準化委員會(IDDSI)為吞嚥障礙患者訂定全球公認的食物質地及液體濃稠度的標準，IDDSI 將食物質地分成八個等級(0 至 7 級)，使用湯匙、叉子、筷子、手指或針筒即可測定食物質地及稠度。[91]

(三) 增加自主控制吞嚥的能力－在吞嚥前先給予提示(verbal cue)或請病人先自我提示(self-cue)(例如先默數 3 秒)再吞嚥，如此在吞嚥啓動前可先保持食團在下頷角(mandible angle)，增加自主控制吞嚥的能力，促進口腔傳送及吞嚥的啓動。[92,93]

值得提醒的是使用代償策略前需先評估病人的認知及語言能力，確認患者可了解並在適當時機使用；如果病人在出院後仍使用代償策略，醫師及治療師等應持續追蹤病人。

臨床有很多可運用的復健策略及吞嚥手法，簡述如下。

(一) 口腔與咽部運動

是以運動為基礎的介入方式，透過口咽或喉部運動及各種吞嚥手法，可改善口咽部力量、喉部閉合、喉部上抬能力、咽部壓力、及環咽肌開啓幅度及時長，以提升整體吞嚥的安全性及效率。口腔與咽部運動可分為(1)非吞嚥的運動和(2)吞嚥運動(吞嚥手法)，非吞嚥的運動執行時沒有做吞嚥的動作，一般而言比較簡單易學，對於需鼻胃管或術後暫時無法由口進食者，也可教導使用非吞嚥的運動。

(1) 非吞嚥的運動包括口唇舌、臉頰、下頜等動作控制運動及舌頭阻抗運動(可使用壓舌板或 Iowa Oral Performance Instrument (IOPI)儀器等)，[94]而咽部的運動包括聲帶閉合、喉部上抬運動(假聲練習)等，病人需有足夠的認知及理解力來記憶及學習。Robbin 等人研究指出舌阻抗運動可增強肌肉強度並促進吞嚥神經的整合而增進吞嚥功能。[95]

薛克氏運動法(Shaker exercise)可增強舌骨上(suprahyoid)肌群的肌肉力量，促進舌骨、喉腔的向上拉提及促進上食道括約肌張開。[96]此運動包含等長收縮及等張收縮運動，執行時採平躺姿，抬頭到能看見腳趾尖的程度但應避免肩部離開床面，維持 1 分鐘(此為等長收縮運動) ，重複執行 3 次，每次休息 1 分鐘；接著做等張收縮運動，方法是連續做抬頭放下達 30 次，中間不休息，[96,97]虛弱的患者若無法一次完成，則視其耐力漸進增加次數，此運動宜在飯前執行或飯後至少一小時才做，有氣切或頸部活動受限制者不可使用。有些病人會因胸鎖乳突肌疲倦或頸部肌肉痠痛不適而限制此運動之執行，因此有下顎張開(jaw opening)及下頦抗阻力(chin tuck against resistance, CTAR)運動法等替代運動提出。

下顎張開及 CTAR 運動與薛克氏運動法類似，都可強化舌骨上肌群的肌力，促進上食道括約肌張開，但較易執行。下顎張開運動是維持下顎張開最大位置 10 秒，休息 10 秒，並多次重複；[98]CTAR 運動是採直立坐姿，在下巴和胸骨柄(manuburium)之間夾住一顆直徑 12 公分具彈性的球，盡量下壓該球後休息，此訓練一樣包含等長收縮及等張收縮運動。[99,100]研究發現以表面肌電圖(sEMG)評估，CTAR 訓練比薛克氏運動法更聚焦於舌骨上肌群，胸鎖乳突肌則比較不會被活化也比較不會疲勞。[101]

吐氣肌訓練(expiratory muscle strength training, EMST)方法是用力快速吐氣到接有單面閥(one-way valve)的吹口裝置，用來訓練吐氣肌及舌骨上肌的力量，研究指出 ESMT 可增加舌骨抬高，增加咳嗽力量及降低氣道吸入，[102] EMST 近年也被運用於腦中風及不同神經疾病(例如巴金森病或運動神經元疾病等)患者的吞嚥治療。[103,104]

(2) 吞嚥手法

各類吞嚥手法可改善吞嚥機轉中不同的吞嚥生理，例如加強聲門閉合、喉部入口關閉、舌根後縮或後咽壁收縮的力量、增加喉部上抬並進而促進上食道括約肌開啓，簡述如下：

舌頭把持運動(tongue hold 或稱 Masako 手法)為請患者以前齒含住舌尖稍後方，並用力吞下唾液，目的是增加上咽肌收縮、強化

咽壁力量及強化舌根後縮。若患者沒有牙齒，可以請病人以手握住舌頭，或請醫護人員戴手套握住患者舌部。研究顯示健康成人執行此運動時可增加口舌的力量，[105]使用此手法以 VFSS 評估可見到吞嚥時會增加後咽壁向前的活動。[106]

孟德爾森吞嚥法(Mendelsohn maneuver)是請患者主動吞嚥並在喉部上提到最高位置時刻意停留數秒，目的是增加喉部上抬的幅度與時長，以增加環咽肌開啓的時間及減少梨狀竇的殘渣。[107]

上聲門吞嚥法(supraglottic swallow)爲請患者先深吸氣後憋氣，保持在閉氣的狀態下吞嚥或進食，進食後在吸氣前要先立即咳嗽以清除誤入氣道或聲帶上的殘留物，[108]超上聲門吞嚥法(super-supraglottic swallow)則是讓病患在吞嚥前用力閉氣並向下壓用力，目的是使杓狀軟骨往前傾而封閉喉前庭，而在吞嚥後立即咳嗽，以上兩個方法都屬於代償策略，原理都是利用閉氣來封閉喉部以避免氣道吸入，適用於吞嚥前或吞嚥中有氣道吸入的患者，但需注意若患者併有心臟冠狀動脈疾病，可能因閉氣而增加心律不整或其他心血管疾病的風險。[109]

用力吞嚥法(effortful swallow)可以改善舌根後縮力量而減少咽部殘留，也可以增加吞嚥時舌頭和咽部的壓力，增加喉前庭關閉時間及喉部上抬的速度及距離，[110,111]適用於谿部或梨狀竇殘留或氣道閉合不足的患者。

孟德爾森吞嚥法、上聲門吞嚥法、超上聲門吞嚥法和用力吞嚥法雖然都屬於代償策略，但在非進食時間也可重複練習當成肌力訓練，以促進患者自主控制咽部吞嚥機轉，並促進神經可塑性，因此同時具有復健及代償的效果。至於執行這些手法的訓練強度、頻率和時間，目前不明確，過去有關肌力訓練的知識大多來自肢體的大肌肉，是否適用於較小的吞嚥肌肉目前仍未知。事實上吞嚥肌肉和肢體肌肉的結構及功能有明顯不同，例如吞嚥肌肉有較低的神經支配率(innervation ratio)，且再生能力也和肢體肌肉不同。[112]

(二) 提高感覺刺激(Sensory Enhancement)

在吞嚥前提高感覺刺激(例如利用冷、酸或觸覺等)可以改善腦中風患者口腔期起始時間及咽部期的啓動。冰冷的食材可提高對食團的覺知力，冷及碳酸液體可改善吞嚥反應時間，減少嗆入、吸入及咽部殘留。[113,114]酸性食團可以改善吞嚥時頦下(submental)肌肉的收縮強度,增加舌頭吞嚥的壓力，並增加神經性吞嚥障礙患者的自主吞嚥效率及減少氣道嗆入、吸入。[115,116]

溫度觸覺刺激(thermal tactile stimulation, TTS)做法是先用間接喉鏡或棉棒(泡過冰水或檸檬水更佳) 輕觸前咽門弓數次再請病患嘗試吞嚥動作，TTS 可以立即提高口腔感覺刺激及提供大腦皮質與腦幹警示的感覺刺激，幫助較快啓動咽部期吞嚥，[117]適用於吞嚥反射消失或吞嚥啓動延遲,在吞嚥前就嗆入或吸入的患者。研究顯示 TTS 可以促進大腦吞嚥皮質的整合，[118]所以同時具有短期及長期的效果。

近年有些創新的研究使用瞬態感受器電位陽離子通道 V1 促進劑（transient receptor potential cation channel V1, TRPV1 agonist)例如辣椒素(capsaicin) 或胡椒鹼(piperine)等，[119-123]藉由增加口咽的感覺刺激來促進吞嚥反射，改善吞嚥功能，未來仍需更多研究來確認其效果。

(三) 神經肌肉電刺激(neuromuscular electrical stimulation, NMES)

NMES 將電極貼片貼在頦下或喉部前方肌肉可以增強吞嚥肌力，[124]目前最常用的是美國食品藥物管理局在 2001 年認可的維生電刺激吞嚥治療儀(Vitalstim)。NMES 使用脈衝電流經電極刺激舌骨上或舌骨下的肌肉使其收縮，[125]研究顯示舌骨上刺激可促進舌骨和喉部上抬，強化吞嚥肌群並促進氣道保護；但當電刺激於頦下及舌骨下肌群時，會使喉部下降，臨床可利用此喉部下降的效果作爲吞嚥時舌骨上抬的阻力訓練。系統性回顧研究指出 NMES 結合其他吞嚥治療用在急性、亞急性或慢性中風病人可短期改善吞嚥功能，效果比只用 NMES 好，[125]但對電極位置、頻率及強度目前仍無定論。NMES 除了促進吞嚥運動單元的徵召(motor unit recruitment),也可運用來增強咽喉感覺回饋路徑，刺激腦部咽部皮質重組。[126,127]

(四)其他治療:包括生理回饋、神經刺激(neurostimulation)及各類組合治療等。

(1) 生理回饋

透過 sEMG、VFSS、FEES 或超音波等不同的方法，提供視覺回饋，幫助病人訓練吞嚥機轉中特定的部位，如聲門關閉、喉部上抬、舌頭動作、舌根後縮、嘴唇閉合等，

中風後吞嚥障礙最常用的生物回饋治療方法是使用 sEMG，將電極貼在頦下或喉前方的肌肉，利用肌肉收縮的時間及力量顯示於螢幕而來訓練病人，例如教導孟德爾森吞嚥法或用力吞嚥法時，使用 sEMG 提供視覺回饋，可以加強學習及訓練效果，系統性研究指出使用 sEMG 生物回饋加上吞嚥手法，對中風吞嚥病人可增加舌骨上抬並改善吞嚥。[125]

(2) 神經電刺激

使用神經電刺激可促進吞嚥皮質整合及加速中風後吞嚥功能的復原，除了前面所提到常用的 NMES 外，近年較新的吞嚥治療方法還包括咽部電刺激、中樞電刺激及成對電刺激(表 1)。

咽部電刺激(pharyngeal electrical stimulation, PES)使用經鼻導管置入咽部表面電極，對咽部中段施予低強度電刺激，可間接促進腦部吞嚥皮質的整合，[129] PES 和 NMES 一樣都屬於週邊電刺激，有研究顯示 PES 可幫助氣切患者早日拔管，[130-132]而愈嚴重的中風患者對 PES 有愈好的反應，[132,133]但有關 PES 的長期效果及最佳的刺激時間及強度等目前仍不明。

中樞電刺激最常用的是經顱刺激，包括經顱重複磁刺激(rTMS)及經顱直流電刺激(tDCS)。

rTMS 是由頭皮經顱骨將電磁刺激傳送至大腦，以誘發腦部特定區域之皮質電生理活動，rTMS 可以調節大腦皮質區神經迴路的興奮性，進而可選擇性對大腦特定腦區有短暫增強或抑制之功能。研究顯示若使用低頻磁刺激(約 1Hz)可對腦部產生抑制效果；而較高頻的磁刺激(≥3Hz)則可增加腦部的刺激性。高頻或低頻磁刺激都可應用於中風後的吞嚥治療。[134,135]使用 rTMS 的策略有兩種，一種是提高腦中風損傷側的興奮性以促進其復原；另一種則是抑制健側腦以減少其對於患側腦的競爭性，使患側腦有較佳的機會修復。系統性回顧研究顯示使用 rTMS 刺激咽部動作皮質區(pharyngeal motor cortex)，並加上傳統吞嚥治療，可以有效改善中風患者的吞嚥功能，[134,135]使用高頻磁刺激效果優於低頻。[134] tDCS 是一種透過貼在頭皮的電極，經由微弱電流(1-2mA)刺激，而調節大腦神經興奮性的非侵入性神經調節技術，[134,136]使用正極(anodal)直流電刺激可增加腦運動皮質的興奮性；而使用陰極(cathodal)直流電刺激會減少神經的興奮性，[133-135]雖然有些研究顯示單側、雙側或雙重(dual)直流電刺激用於中風後吞嚥障礙患者者可促進吞嚥功能恢復，[136-138]但最適當的治療方式目前未達定論。使用經顱刺激需經專業訓練的醫師執行，避免癲癇或頭皮燒傷等風險。[139]

成對電刺激(paired associated stimulation, PAS)是同時使用週邊和中樞神經電刺激來治療吞嚥障礙，[140]研究顯示使用 PAS 治療慢性中風吞嚥障礙，可增加咽部動作皮質代表區(motor cortex representation)，[141,142]活化大腦皮質與延髓(corticobulbar)的興奮性，改善吞嚥功能，有關 PAS 的研究不多，未來仍需更多研究來確認療效。

(3) 各類組合治療

近年也有不少研究組合不同的治療及評估來治療中風後的吞嚥障礙，[143-148]也有研究顯示 NMES 加上 rTMS 用於治療中風後吞嚥障礙比單純只用 NMES 更能促進腦皮質活化及改善吞嚥功能，且兩側 rTMS 加上 NMES 效果比單側更好。[148]

預防中風相關的肺炎及用藥

中風相關的肺炎(stroke-associated pneumonia, SAP)指的是中風後 7 天內發生的肺炎，[149]中風後的肺炎是多重原因造成的，包括中風前幾天內免疫功能降低，易嗆入或吸入口咽分泌物或胃食道逆流物質、咳嗽能力降低及口腔衛生不良等，[150]此外中風會改變口腔內正常菌群，這和口咽殘留、牙菌濃度、口內念珠菌感染或抗生素使用等因素有關。中風病人使用鼻胃管灌食者，發生肺炎的比率比由口進食者多，[151]禁食及管灌飲食者仍可能被口水或逆流物嗆到，[151]所以避免嘔吐、胃食道逆流及嚴格的口腔衛生照顧對急性中風病人非常重要。值得提醒的是神經失能病患因多種原因常無法清潔口腔，需定期仰賴他人協助以保持口腔衛生，降低口咽部有害細菌的菌落數，可以明顯減少肺炎的發生率，雖然最佳的口腔清潔劑仍未知，但使用稀釋過的氯己定(chlorhexidine)對中風患者的口腔衛生會有幫助。[152]

中風後吸入的風險在 2 週內最高，因此早期預防吸入性肺炎至少應持續 2 週。Langdon 等人發現急性中風病人住院時活動障礙會增加肺炎的風險，[153]腦中

風後吞嚥治療需多專業團隊介入，包括各相關科的醫師(神經、復健、腸胃、胸腔、耳鼻喉、牙科或放射線科等)、護理師、物理、職能、語言及呼吸治療師、營養師、藥師、口衛師、放射師等多專業整合照護病人，可明顯減少中風後肺炎的發生，整合照護包括早期篩檢並早期診斷吞嚥障礙，早期介入調整食物的質地或提供腸道灌食，減少嗆入或吸入的量及頻率，強化咽喉感覺，加強咳嗽等保護功能；各類吞嚥治療促進皮質整合及早期肢體活動等。另外腦中風患者若有較高的咳嗽氣流，可以減少肺炎的風險，[154]使用用力哈氣訓練(huffing technique)也可以幫助排痰及減少氣道吸入量。[155]

有關中風後預防肺炎的用藥，證據顯示使用預防性的抗生素並不能減少中風後肺炎。[156]急性中風後無法由口進食的病人若使用氫離子幫浦抑制劑(proton pump inhibitor, PPI)會增加肺炎風險，但組織胺阻斷劑(H2 blocker)類則不會，顯示對這類高風險病患應避免使用 PPI。[157]原因是 PPI 藥物雖然可以減少胃酸分泌來預防與抗血小板藥或與壓力有關的黏膜損傷，但是它們的使用可能會促進上消化道中病原菌的生長，對於吞嚥控制不良的急性中風患者，可能會導致吸入性肺炎。[158] 也有報告顯示急性中風後插鼻胃管的病人使用美多普胺(metoclopramide)可以明顯減少肺炎的風險，機轉可能和減少嘔吐、改善下食道括約肌的肌張力及增加胃排空、減少胃食道逆流有關。[159]

咳嗽是降血壓藥物血管張力素轉化酶抑制劑(angiotensin converting enzyme inhibitor, ACEI)常見的副作用，證據顯示使用 ACEI 可以有效減少中風後的肺炎，這可能和 ACEI 可以誘發咳嗽保護機轉有關，ACEI 可能可促進 P 物質累積進而誘發吞嚥和咳嗽反射，但此研究只用在慢性中風病人，至於 ACEI 爲什麼在亞洲人預防肺炎的作用比高加索人種更明顯，[160]目前原因仍不明；而 Cilostazol 抗血小板藥物在慢性中風病人也可減少肺炎，可能和 ACEI 類似，和影響緩激肽(bradykinin)和 P 物質有關。[161]

過去研究顯示左旋多巴(levodopa)藥物可以改善吞嚥反射，[162]阿曼他定(amantadine)或過乳降錠(cabergoline)類藥物可以減少中風病人的夜間吸入，[162,163]機轉可能和這類藥物可以增加多巴胺的量有關，也有研究報告阿曼他定藥物可以減少中風病人肺炎的風險，[164]未來仍需更多研究來確認找出對中風後吞嚥復健最適宜的藥物。

表 1. 神經電刺激應用於吞嚥復健

週邊電刺激	神經肌肉電刺激(NMES)	普遍使用，價格便宜
	咽部電刺激	未普遍使用
中樞電刺激	經顱重複磁刺激(rTMS)	非常規使用，爲臨床研究用價格高
	經顱直流電刺激	非常規使用，爲臨床研究用價格不高
週邊及中樞電刺激	成對電刺激	未普遍使用

結論及建議

綜合以上所述，腦中風吞嚥障礙的治療應保持以下原則：早期篩檢診斷、早期介入治療、持續追蹤。治療腦中風病人的吞嚥障礙越早開始越好，病人相對會有比較好的營養狀況、足夠水分與良好的生活品質，也減少肺炎或其他併發症發生。

及早吞嚥篩檢，進一步接受專業吞嚥評估，必要時安排儀器評估，才能確認造成吞嚥障礙的潛在問題，並依照評估結果給予適當的處置，腦中風吞嚥復健計畫的擬訂及建議，需依據患者的病情變化適時調整，也必需考量及尊重病人及家屬的意願及喜好，充分溝通並提供病人及家屬心理支持，以提高對復健計畫的參與度。多專業團隊的介入可減少中風後肺炎的風險，[165]有關吞嚥的研究，目前大多都沒有高品質的大型研究提供足夠證據來支持治療的臨床及長期效果，[166]未來仍需更多研究以找出對中風後吞嚥復健最適宜的治療。

參考文獻

1. Smithard DG, O’Neill P, England R, et al. The natural history of dysphagia following a stroke. Dysphagia 1997;12:188-93.
2. Mann G, Hankey GJ, Cameron D. Swallowing

disorders following acute stroke: prevalence and diagnostic accuracy. Cerebrovasc Dis 2000;10: 380-6.

3. Paciaroni M, Mazzotta G, Corea F, et al. Dysphagia following stroke Eur Neurol 2004;51:162-7.
4. Martino R, Foley N, Bhogal S, et al. Dysphagia after stroke: incidence, diagnosis, and pulmonary complications. Stroke 2005;36:2756-63.
5. Arnold M, Liesirova K, Broeg-Morvay A, et al. Dysphagia in acute stroke: incidence, burden and impact on clinical outcome. PLoS One 2016;11: e0148424
6. Ekberg O, Hamdy S, Woisard V, et al. Social and psychological burden of dysphagia: its impact on diagnosis and treatment. Dysphagia 2002;17:139-46.
7. Nguyen VQ, PrvuBettger J, Guerrier T, et al. Factors associated with discharge to home versus discharge to institutional care after inpatient stroke rehabilitation. Arch Phys Med Rehabil 2015;96: 1297-303.
8. Feng MC, Lin YC, Chang YH, et al. The mortality and the risk of aspiration pneumonia related with dysphagia in stroke patients. J Stroke Cerebrovasc Dis 2019;28:1381-7.
9. Smithard DG, O'Neill PA, Parks C, et al. Complications and outcome after acute stroke. Does dysphagia matter? Stroke 1996;27:1200-4.
10. Mann G, Hankey GJ, Cameron D. Swallowing function after stroke: prognosis and prognostic factors at 6 months. Stroke 1999;30:744-8.
11. Leder SB, Sasaki CT, Burrell MI. Fiberoptic endoscopic evaluation of dysphagia to identify silent aspiration. Dysphagia 1998;13:19-21.
12. Ramsey D, Smithard D, Kalra L. Silent aspiration: what do we know? Dysphagia 2005;20:218-25.
13. Titsworth WL, Abram J, Fullerton A, et al. Prospective quality initiative to maximize dysphagia screening reduces hospital-acquired pneumonia prevalence in patients with stroke. Stroke 2013;44:3154-60.
14. Ramsey DJC, Smithhard DG, Kalra L. Early assessments of dysphagia and aspiration risk in acute stroke patients. Stroke. 2003;34:1252-7.
15. Smith C, Logemann J, Colangelo L, et al. Incidence and patient characteristics associated with silent aspiration in the acute care setting. Dysphagia 1999;14:1-7.
16. Aviv J, Martin J, Samlo R, et al. Supraglottic and pharyngeal sensory abnormalities in stroke patients with dysphagia. Ann Otol Rhinol Laryngol 1996;105:92-7.
17. Lee ML, Kim JU, Oh DH, et al. Oropharyngeal swallowing function in patients with presbyphagia. J Phys Ther Sci 2018;30:1357-8.
18. Baijens LW, Clave P, Cras P, et al. European Society for Swallowing Disorders-European Union Geriatric Medicine Society white paper: Oropharyngeal dysphagia as a geriatric syndrome. Clin. Interv Aging 2016;11:1403-28.
19. Wang ZY, Chen JM, Ni GX. Effect of an indwelling nasogastric tube on swallowing function in elderly post-stroke dysphagia patients with long-term nasal feeding. BMC Neurol 2019;19:83.
20. Wilmskoetter J, Daniels SK, Miller AJ. Cortical and Subcortical Control of Swallowing-Can We Use Information From Lesion Locations to Improve Diagnosis and Treatment for Patients With Stroke? Am J Speech Lang Pathol 2020;29:1030-43.
21. Babaei A, Ward BD, Siwiec RM, et al. Functional connectivity of the cortical swallowing network in humans. Neuroimage 2013;76:33-44.
22. Lowell SY, Reynolds RC, Chen G, et al. Functional connectivity and laterality of the motor and sensory components in the volitional swallowing network. Exp Brain Res 2012;219:85-96.
23. Jean A. Brain stem control of swallowing: neuronal network and cellular mechanisms. Physiol Rev 2001;81:929-69.
24. Wilmskoetter J, Daniels SK, Miller AJ. Cortical and Subcortical Control of Swallowing-Can We Use Information From Lesion Locations to Improve Diagnosis and Treatment for Patients With Stroke? Am J Speech Lang Pathol 2020;29:1030-43.
25. Daniels SK, Pathak S, Mukhi SV,et al. The relationship between lesion localization and dysphagia in acute stroke. Dysphagia 2017;32: 777-84.
26. Kim SY, Kim TU, Hyun JK, et al. Differences in videofluoroscopic swallowing study (VFSS) findings amlording to the vascular territory involved in stroke. Dysphagia 2014;29:444-9.

27. Moon HI, Nam JS, Leem MJ, et al. Periventricular white matter lesions as a prognostic factor of swallowing function in older patients with mild stroke. Dysphagia 2017;32:480-6.
28. Moon HI, Kim GS, Lee E. Is the location of white matter lesions important in the swallowing function of older patients with mild stroke? Dysphagia 2019;34:407-14.
29. Wilmskoetter J, Bonilha L, Martin-Harris B, et al. Mapping acute lesion locations to physiological swallow impairments after stroke. Neuroimage Clin 2019;22:101685
30. Li S, Luo C, Yu B, et al. Functional magnetic resonance imaging study on dysphagia after unilateral hemispheric stroke: a preliminary study. J Neurol Neurosurg Psychiatry 2009; 80:1320-9.
31. Teismann IK, Suntrup S, Warnecke T, et al. Cortical swallowing processing in early subacute stroke. BMC Neurol 2011;11:34.
32. Barritt A, Smithard D. Role of cerebral cortex plasticity in the recovery of swallowing function following dysphagic stroke. Dysphagia 2009;24: 83-90.
33. Hinchey JA, Shephard T, Furie K, et al. Formal dysphagia screening protocols prevent pneumonia. Stroke 2005;36:1972-6.
34. Al-Khaled M, Matthis C, Binder A, et al. Dysphagia in patients with acute ischemic stroke: Early dysphagia screening may reduce stroke-related pneumonia and improve stroke outcomes. Cerebrovasc Dis 2016;42:81-9.
35. Bray BD, Smith CJ, Cloud GC, et al. The association between delays in screening for and assessing dysphagia after acute stroke, and the risk of stroke-associated pneumonia. J Neurol Neurosurg Psychiatry 2017;88:25-30.
36. Palli C, Fandler S, Doppelhofer K, et al. Early dysphagia screening by trained nurses reduces pneumonia rate in stroke patients: a clinical intervention study. Stroke 2017;48:2583-5.
37. Joundi RA, Martino R, Saposnik G, et al. Predictors and outcomes of dysphagia screening after acute ischemic stroke. Stroke 2017;48:900-6.
38. Garand KL, Mmlullough G, Crary M, et al. Assessment across the life span: the clinical swallow evaluation. Am J Speech-Lang Pathol 2020;29: 919-33.
39. Turner-Lawrence DE, Peebles M, Price MF, et al. A feasibility study of the sensitivity of emergency physician dysphagia screening in acute stroke patients. Ann Emerg Med 2009;54:344-8.
40. Steele CM, Molfenter S, Bailey GL, et al. Exploration of the utility ofa brief swallow screening protocol with comparison to concurrent videofluoroscopy. Canadian J Speech-Language Pathology Audiology2011;35: 228-42.
41. Ellis AL, Hannibal RR. Nursing swallow screens: why is testing wateronly not enough? J Neurosci Nurs 2013;45:244-53.
42. Brodsky MB, Suiter DM, González-Fernández M, et al. Screening amluracy for aspiration using bedside water swallow tests: a systematic review and meta-analysis. Chest 2016;150:148-63.
43. DePippo KL, Holas MA, Reding MJ. Validation of the 3-oz waterswallow test for aspiration following stroke. Arch Neurol 1992;49:1259-61.
44. Suiter DM, Leder SB. Clinical utility of the 3-ounce water swallow test. Dysphagia 2008;23:244-50.
45. Wu MC, Chang YC, Wang TG, et al. Evaluating swallowing dysfunction using a 100-ml water swallowing test. Dysphagia 2004;19:43-7.
46. Osawa A, Maeshima S, Tanahashi N. Water-swallowing test: screening for aspiration in stroke patients. Cerebrovasc Dis 2013;35:276-81.
47. Watanabe S, Oh-Shige H, Oh-Iwa I, et al. Reconsideration of three screening tests for dysphagia in patients with cerebrovascular disease performed by non-expert examiners. Odontology 2020;108:117-23.
48. Perry L. Screening swallowing function of patients with acute stroke. Part one: Identification, implementation and initial evaluation of a screening tool for use by nurses. J Clin Nurs 2001;10:463-73.
49. Clavé P, Arreola V, Romea M, et al. Amluracy of the volume-viscosity swallow test for clinical screening of oropharyngeal dysphagia and aspiration. Clin Nutr 2008;27:806-15.
50. Rofes L, Arreola V, Mukherjee R, et al. Sensitivity and specificity of the eating assessment tool and the volume-viscosity swallow test for clinical evaluation

of oropharyngeal dysphagia. Neurogastroent Motil 2014;26:1256-65.

51. Benfield JK, Everton LF, Bath PM, et al. Amluracy and clinical utility of comprehensive dysphagia screening assessments in acute stroke: a systematic review and meta-analysis. J Clin Nurs 2020;29: 1527-38.
52. Mulheren RW, González-Fernández M. Swallow screen associated with airway protection and dysphagia after acute stroke. Arch Phys Med Rehabil 2019;100:1289-93.
53. Daniels SK, Anderson JA, Willson PC. Valid items for screening dysphagia risk in patients with stroke: a systematic review. Stroke 2012;43;892-7.
54. Jauch EC, Saver JL, Adams HP, et al. Guidelines for the early management of patients with acute ischemic stroke: A guideline for healthcare professionals from the American Heart Association/American Stroke Association. Stroke 2013;44:870-947.
55. Powers WJ, Rabinstein AA, Ackerson T, et al. Guidelines for the early management of patients with acute ischemic stroke: 2019 update to the 2018 guidelines for the early management of acute ischemic stroke: a guideline for healthcare professionals from the American Heart Association/ American Stroke Association. Stroke 2019;50: e344-418.
56. Martino R, Silver F, Teasell R, et al. The Toronto Bedside Swallowing Screening Test (TOR-BSST): development and validation of a dysphagia screening tool for patients with stroke. Stroke 2009;40:555-61.
57. Donovan NJ, Daniels SK, Edmiaston J, et al. American Heart Association Council on Cardiovascular Nursing and Stroke Council. Dysphagia screening: state of the art: invitational conference proceeding from the State-of-the-Art Nursing Symposium. Stroke 2013;44:e24-31
58. Intercollegiate Stroke Working Party. National Clinical Guideline for Stroke. Fifth Edition. 2016. London, Royal College of Physicians. https://www.strokeaudit.org/Guideline/Full-Guideline.aspx (June 27, 2017).
59. Casaubon LK, Boulanger J-M, Glasser E, et al. Canadian Stroke Best Practice Recommendations: Acute Inpatient Stroke Care Guidelines, Update 2015. International Journal of Stroke 2016;11:239-52.
60. Watkins J: Clinical Guidelines for Stroke Management 2017. Melbourne Australia, National Manager Clinical Services, stroke foundation, 2017.
61. Crary MA, Carnaby GD, Sia I, et al. Spontaneous swallowing frequency has potential to identify dysphagia in acute stroke. Stroke 2013;44:3452-7.
62. Niimi M, Hashimoto G, Hara T, et al. Relationship between frequency of spontaneous swallowing and salivary substance P level in patients with acute stroke Dysphagia 2018;33:414-8.
63. Carnaby G, Sia I, Crary MA. Associations between spontaneous swallowing frequency at admission, dysphagia, and stroke-related outcomes in acute care. Arch Phys Med Rehabil 2019;100:1283-8.
64. Persson E, Wårdh I, Östberg P. Repetitive saliva swallowing test: norms, clinical relevance and the impact of saliva secretion. Dysphagia 2019;34: 271-8.
65. Niimi M, Hashimoto G, Hara T, et al. The 2-minute spontaneous swallowing screening predicts independence on enteral feeding in patients with acute stroke. Journal of Stroke and Cerebrovascular Diseases 2020;29:104508.
66. Garuti G, Reverberi C, Briganti A, et al. Swallowing disorders in tracheostomised patients: a multidisciplinary/multiprofessional approach in decannulation protocols. Multidiscip Respir Med 2014;9:36.
67. Bechet S, Hill F, Gillheaney O, et al. Diagnostic amluracy of the modified Evan's blue dye test in detecting aspiration in patients with tracheostomy: a systematic review of the evidence. Dysphagia 2016;31:721-9.
68. Knigge MA, Thibeault S, Mmlulloch TM. Implementation of high-resolution manometry in the clinical practice of speech language pathology. Dysphagia 2014;29:2-16.
69. Costa MMB. Videofluoroscopy: the gold standard exam for studying swallowing and its dysfunction. Arq Gastroenterol 2010;47:327-8.
70. Kim SB, Lee SJ, Lee KW, et al. Usefulness of early videofluoroscopic swallowing study in acute stroke

patients with dysphagia. Ann Rehabil Med 2018;42:42-51.

71. Crary M and Baron J. Endoscopic and fluroscopic evaluations of swallowing: comparison of observed and inferred findings. Dysphagia 1997; 2:108.

72. Langmore SE, Schatz K, Olsen N. Fiberoptic endoscopic examination of swallowing safety: a new procedure. Dysphagia 1988;2:216-9.

73. Leder SB. Serial fiberoptic endoscopic swallowing evaluations in the management of patients with dysphagia. Arch Phys Med Rehabil 1998;79:1264–9.

74. Aviv JE, Kaplan ST, Thomson JE, et al. The safety of flexible endoscopic evaluation of swallowing with sensory testing (FEESST): an analysis of 500 consecutive evaluations. Dysphagia 2000;15:39-44.

75. Bax L, McFarlane M, Green E, et al. Speech-language pathologist-led fiberoptic endoscopic evaluation of swallowing: functional outcomes for patients after stroke. J Stroke Cerebrovasc Dis 2014;23:e195-200.

76. Bours GJJW, Speyer R, Lemmens J, et al. Bedside screening tests vs. videofluoroscopy or fibreoptic endoscopic evaluation of swallowing to detect dysphagia in patients with neurological disorders: Systematic review. Journal of Advanced Nursing 2008;65:477-93.

77. Giraldo-Cadavid LF, Leal-Leaño LR, Leon-Basantes GA, et al. Accuracy of endoscopic and videofluoroscopic evaluations of swallowing for oropharyngeal dysphagia. Laryngoscope 2017;127: 2002-10.

78. Welch MW, Logemann JA, Rademaker AW, et al. Changes in pharyngeal dimensions effected by chin tuck. Arch Phys Med Rehabil 1993;74:178-81.

79. Mmlulloch TM, Hoffman MR, Ciumli MR. High resolution manometry of pharyngeal swallow pressure events associated with head turn and chin tuck. Ann Otol Rhinol Laryngol 2010;119:369-76.

80. Hori K, Tamine K, Barbezat C, et al. Influence of chin-down posture on tongue pressure during dry swallow and bolus swallows in healthy subjects. Dysphagia 2011;26:238-45.

81. Shanahan TK, Logemann JA, Rademaker AW, et al. Chin-down posture effect on aspiration in dysphagic patients. Arch Phys Med Rehabil 1993;74:736-9.

82. Logemann JA, Gensler G, Robbins J, et al. A randomized study of three interventions for aspiration of thin liquids in patients with dementia and Parkinson’s disease. J Speech Lang Hear Res 2008;51:173-83.

83. Nagaya M, Kachi T, Yamada T, et al. Videofluorographic observations on swallowing in patients with dysphagia due to neurodegenerative diseases. Nagoya J Med Sci 2004;67:17-23.

84. Kim CK, Ryu JS, Song SH, et al. Effects of head rotation and head tilt on pharyngeal pressure events using high resolution manometry. Ann Rehabil Med 2015;39:425.

85. Logemann JA, Kahrilas PJ, Kobara M, et al. The benefit of head rotation on pharyngoesophageal dysphagia. Arch Phys Med Rehabil 1989;70:767-71.

86. Rasley A, Logemann JA, Kahrilas PJ, et al. Prevention of barium aspiration during videofluoroscopic swallowing studies: value of change in posture. AJR Am J Roentgenol 1993; 160:1005-9.

87. Drake W, O'Donoghue S, Bartram C, et al. Eating in side-lying facilitates rehabilitation in neurogenic dysphagia. Brain Inj 1997;11:137-42.

88. Matsui T, Yamaya M, Ohrui T, et al. Sitting position to prevent aspiration in bed-bound patients. Gerontology 2002;48:194-5.

89. Dantas RO, Kern MK, Massey BT, et al. Effect of swallowed bolus variables on oral and pharyngeal phases of swallowing. Am J Physiol 1990;258: G675-81.

90. Matta Z, Chambers IVE, Garcia JM, et al. Sensory characteristics of beverages prepared with commercial thickeners used for dysphagia diets. J Am Diet Assoc 2006;106:1049-54.

91. CM. Steele, AM Namasivayam, Brittany T. et al. Creation and Initial Validation of the International Dysphagia Diet Standardisation Initiative Functional Diet Scale. Arch Phys Med Rehabil 2018; 99:934-4.

92. Daniels SK, Schroeder MF, De George PC, et al. Effects of verbal cue on bolus flow during swallowing. Am J Speech Lang Pathol 2007;16: 140-7.

93. Butler SG, Pelletier CA, Steele CM. Compensatory strategies and techniques. In: Shaker R, Easterling C,

Belafsky PC, Postma GN, editors. Manual of diagnostic and therapeutic techniques for disorders of deglutition. New York: Springer. 2013;299-316.

94. Adams V, Mathisen B, Baines S, et al. : Reliability of measurements of tongue and hand strength and endurance using the Iowa Oral Performance Instrument with elderly adults. Disabil Rehabil 2015,37:389-95.

95. Robbins J, Kays SA, Gangnon RE, et al. The effects of lingual exercise in stroke patients with dysphagia. Arch Phys Med Rehabil 2007;88:150-8.

96. Shaker R, Kern M, Bardan E, et al. Augmentation of deglutitive upper esophageal sphincter opening in the elderly by exercise. Am J Physoil 1997;272: G1518-22.

97. Easterling C, Grande B, Kern M, et al. Attaining and maintaining isometric and isokinetic goals of the shaker exercise. Dysphagia 2005;20:133-8.

98. Wada S, Tohara H, Iida T, et al. Jaw opening exercise for insufficient opening of upper esophageal sphincter. Arch Phys Med Rehabil 2012;93:1995-9.

99. Yoon WL, Khoo JKP, Liow SJR. Chin tuck against resistance (CTAR): new method for enhancing suprahyoid muscle activity using a Shaker-type exercise. Dysphagia 2014;29:243-8.

100. Park JS, An DH, Oh DH, et al. Effect of chin tuck against resistance exercise on patients with dysphagia following stroke: a randomized pilot study. Neuro Rehabilitation 2018;42:191-7.

101. Sze WP, Yoon WL, Escoffier N, et al. Evaluating the training effects of two swallowing rehabilitation therapies using surface electromyography-chin tuck against resistance (CTAR) exercise and the shaker exercise. Dysphagia 2016;31:195-205.

102. Hegland KW, Davenport PW, Brandimore AE, et al. Rehabilitation of swallowing and cough functions following stroke: an expiratory muscle strength training trial. Arch Phys Med Rehabil 2016;97: 1345–51.

103. Troche MS, Okun MS, Rosenbek JC, et al. Aspiration and swallowing in Parkinson disease and rehabilitation with EMST: a randomized trial. Neurology 2010;7:1912-9.

104. Wang Z, Wang Z, Fang Q, et al. Effect of Expiratory Muscle Strength Training on Swallowing and Cough Functions in Patients With Neurological Diseases: A Meta-analysis. Am J Phys Med Rehabil 2019;98: 1060-6.

105. Fujiu-Kurachi M, Fujiwara S, Tamine K, et al. Tongue pressure generation during tongue-hold swallows in young healthy adults measured with different tongue positions. Dysphagia 2014;29: 17-24.

106. Fujiu M, Logemann JA. Effect of a tongue-holding maneuver on posterior pharyngeal wall movement during deglutition. Am J Speech Lang Pathol 1996;5:23-30

107. Mmlullough GH, Kamarunas, E, Mann GC, et al. Effects of Mendelsohn maneuver on measures of swallowing duration post stroke. Top Stroke Rehabil 2012;19:234-43.

108. Mendelsohn MS, Martin RE. Airway protection during breath-holding. Ann Otol Rhinol Laryngol 1993;102:941-4.

109. Chaudhuri G, Hildner CD, Brady S, et al. Cardiovascular effects of the supraglottic and supersupraglottic swallowing maneuvers in stroke patients with dysphagia. Dysphagia 2002;17:19-23.

110. Huckabee ML, Steele CM. An analysis of lingual contribution to submental surface electromyographic measures and pharyngeal pressures during effortful swallow. Arch Phys Med Rehabil 2006;87:1067-72.

111. Jang HJ, Leigh JH, Seo HG, Han TR, Oh BM. Effortful swallow enhances vertical hyolaryngeal movement and prolongs duration after maximal excursion. J Oral Rehabil 2015;42(10):765-73.

112. Connor NP, Ota F, Nagai H, et al. Differences in age-related alterations in muscle contraction properties in rat tongue and hindlimb. J Speech Lang Hear Res 2008;51:818-27.

113. Michou E, Mastan A, Ahmed S, et al. Examining the role of carbonation and temperature on water swallowing performance: a swallowing reaction-time study. Chem Senses 2012;37:799-807.

114. Sdravou K, Walshe M. Effects of carbonated liquids on oropharyngeal swallowing measures in people with neurogenic dysphagia. Dysphagia 2012;27: 240-50.

115. Palmer PM, Mmlulloch TM, Jaffe D, et al. Effects of a sour bolus on the intramuscular electromyographic

(EMG) activity of muscles in the submental region. Dysphagia 2005;20:210-7.

116. Pelletier CA, Dhanaraj GE. The effect of taste and palpability on lingual swallowing pressure. Dysphagia 2006;21:121-8.

117. Rosenbek JC, Roecker EB, Wood JL, et al. Thermal application reduces the duration of stage transition in dysphagia after stroke. Dysphagia 1996;11:225-33.

118. Teismann IK, Steinsträter O, Warnecke T.et al. Tactile thermal oral stimulation increases the cortical representation of swallowing. BMC Neurosci 2009;10:71.

119. Shin S, Shutoh N, Tonai M, et al. The effect of capsaicin-containing food on the swallowing response. Dysphagia 2016;31:146-53.

120. Wang Z, Wu L, Fang Q, et al. Effects of capsaicin on swallowing function in stroke patients with dysphagia: A randomized controlled trial. J Stroke Cerebrovasc Dis 2019;28:1744-51.

121. Cabib C, Nascimento W, Rofes L, et al. Short-term neurophysiological effects of sensory pathway neurorehabilitation strategies on chronic poststroke oropharyngeal dysphagia. Neurogastroenterol Motil 2020;32:e13887.

122. Rofes L, Arreola V, Martin A. et al. Effect of oral piperine on the swallow response of patients with oropharyngeal dysphagia. J Gastroenterol 2014;49: 1517-23.

123. Alvarez-Berdugo D, Rofes L, Farré R, et al. Localization and expression of TRPV1 and TRPA1 in the human oropharynx and larynx. Neurogastroenterol Motil 2016;28:91-100.

124. Freed ML, Freed L, Chatburn RL, et al. Electrical stimulation for swallowing disorders caused by stroke. Respiratory Care 2001;46:466-74.

125. Chen YW, Chang KH, Chen HC, et al. The effects of surface neuromuscular electrical stimulation on poststroke dysphagia: a systemic review and meta-analysis. Clin Rehabil 2016;30:24-35.

126. Bergquist AJ, Clair JM, Lagerquist O, et al. Neuromuscular electrical stimulation: implications of the electrically evoked sensory volley. European Journal of Applied Physiology 2011;111:2409-26.

127. Oh BM, Kim DY, Paik NJ. Recovery of swallowing function is amlompanied by the expansion of the cortical map. Int J Neurosci 2007;117:1215-27.

128. Benfield JK, Everton LF, Bath PM, et al. Does therapy with biofeedback improve swallowing in adults with dysphagia? A systematic review and meta-analysis. Arch Phys Med Rehabil 2019;100: 551-61.

129. Vasant DH, Michou E, O’Leary N, et al. Pharyngeal electrical stimulation in dysphagia poststroke: a prospective, randomized single-blinded interventional study. Neurorehabil Neural Repair 2016;30:866-75.

130. Suntrup S, Marian T, Schröder JB, et al. Electrical pharyngeal stimulation for dysphagia treatment in tracheotomized stroke patients: a randomized controlled trial. Intensive Care Med 2015;41: 1629-37.

131. Muhle P, Suntrup-Krueger S, Bittner S, et al. Increase of substance P concentration in saliva after pharyngeal electrical stimulation in severely dysphagic stroke patients-an indicator of decannulation sumless? Neurosignals2017;25:74-87.

132. Dziewas R, Stellato R, van der Tweel I, et al. Pharyngeal electrical stimulation for early decannulation in tracheotomised patients with neurogenic dysphagia after stroke (PHAST-TRAC): a prospective, single-blinded, randomised trial. Lancet Neurol 2018;17:849-59.

133. Bath PM, Scutt P, Love J, et al. Pharyngeal electrical stimulation for treatment of dysphagia in subacute stroke: a randomized controlled trial. Stroke 2016;47:1562-70.

134. Pisegna JM, Kaneoka A, Pearson WG, et al. Effects of non-invasive brain stimulation on post-stroke dysphagia: a systematic review and meta-analysis of randomized controlled trials. Clin Neurophysiol 2016;127:956-68.

135. Liao X, Xing G, Guo Z, et al. Repetitive transcranial magnetic stimulation as an alternative therapy for dysphagia after stroke: a systematic review and meta-analysis. Clin Rehabil 2017;31:289-98.

136. Ahn YH, Sohn HJ, Park JS, et al. Effect of bihemispheric anodal transcranial direct current stimulation for dysphagia in chronic stroke patients: a randomized clinical trial. J Rehabil Med 2017;49:30-5.

137. Li Y, Feng H, Li J, et al. The effect of transcranial direct current stimulation of pharyngeal motor cortex on swallowing function in patients with chronic dysphagia after stroke: a retrospective cohort study. Medicine (Baltimore) 2020;99:e19121
138. Pingue V, Priori A, Malovini A, et al. Dual transcranial direct current stimulation for Poststroke dysphagia: a randomized controlled trial. Neurorehabil Neural Repair 2018;32:635-44.
139. Rossi S, Hallett M, Rossini PM, et al. Safety, ethical considerations, and application guidelines for the use of transcranial magnetic stimulation in clinical practice and research. Clin Neurophysiol 2009;120: 2008-39.
140. Stefan K, Kunesch E, Cohen LG, et al. Induction of plasticity in the human motor cortex by paired associative stimulation. Brain 2000;123 Pt 3:572-84.
141. Michou E, Mistry S, Jefferson S, et al. Targeting unlesioned pharyngeal motor cortex improves swallowing in healthy individuals and after dysphagic stroke. Gastroenterology 2012;142:29-38.
142. Singh S, Mistry S, Jefferson S, et al. A magnetic resonance spectroscopy study of brain glutamate in a model of plasticity in human pharyngeal motor cortex. Gastroenterology 2009;136:417-24.
143. Sun SF, Hsu CW, Lin HS, et al. Combined neuromuscular electrical stimulation (NMES) with fiberoptic endoscopic evaluation of swallowing (FEES) and traditional swallowing rehabilitation in the treatment of stroke-related dysphagia. Dysphagia 2013;28:557-66.
144. Park JS, Hwang NK, Kim HH, et al. Effect of neuromuscular electrical stimulation combined with effortful swallowing using electromyographic biofeedback on oropharyngeal swallowing function in stroke patients with dysphagia: a pilot study. Medicine2019;98:e17702.
145. Li LX, Deng K. Acupuncture combined with swallowing training for poststroke dysphagia: a meta-analysis of randomised controlled trials. Acupunct Med 2019;37:81-90.
146. Carnaby GD, LaGorio L, Silliman S, et al. Exercise-based swallowing intervention (McNeill Dysphagia Therapy) with adjunctive NMES to treat dysphagia post-stroke: A double-blind placebo-controlled trial. J Oral Rehabil 2020;47: 501-10.
147. Cui F, Yin Q, Wu C, et al. Capsaicin combined with ice stimulation improves swallowing function in patients with dysphagia after stroke: A randomised controlled trial. J Oral Rehabil 2020;47:1297-303.
148. Zhang C, Zheng X, Lu R, et al. Repetitive transcranial magnetic stimulation in combination with neuromuscular electrical stimulation for treatment of post-stroke dysphagia. J Int Med Res 2019;47:662-72.
149. Smith JC, Kishore KA, Vail A, et al. Diagnosis of stroke associated pneumonia: recommendations from the pneumonia in stroke consensus group. Stroke 2015;46:2335-40
150. Hoffmann S, Harms H, Ulm L, et al. Stroke-induced immunodepression and dysphagia independently predict stroke-associated pneumonia-the PREDICT study. J Cereb Blood Flow Metab 2017;37:3671-82.
151. Gomes G, Pisani J, Macedo E, et al. The nasogastric feeding tube as a risk factor for aspiration and aspiration pneumonia. Curr Opin Clin Nutr Metabol Care 2003;6:327-33.
152. Brady M, Furlanetto D, Hunter R, et al. Staff-led interventions for improving oral hygiene in patients following stroke. Cochrane Database Syst Rev 2006;4:CD003864.
153. Eltringham SA, Kilner K, Gee M. et al. Factors associated with risk of stroke-associated pneumonia in patients with dysphagia: asystematic review. Dysphagia 2020;35:735-44.
154. Kulnik ST, Birring SS, Hodsoll J, et al. J, L. Higher cough flow is associated with lower risk of pneumonia in acute stroke. Thorax 2016;71:474-5.
155. Hasani A, Pavia D, Agnew JE, et al. Regional lung clearance during cough and forced expiration technique (FET): effects of flow and viscoelasticity. Thorax 1994;49:557-61.
156. Kalra L, Irshad S, Hodsoll J, et al. Prophylactic antibiotics after acute stroke for reducing pneumonia in patients with dysphagia (STROKE-INF): a prospective, cluster-randomised, open-label, masked endpoint, controlled clinical trial. Lancet 2015;386: 1835-44.
157. Arai N, Nakamura A, Tabuse M, et al. Histamine

H2-blocker and proton pump inhibitor use and the risk of pneumonia in acute stroke: a retrospective analysis on susceptible patients. PLoS ONE 2017;12:e0169300.

158. Marchina S, Doros G, Modak J, et al. Acid-suppressive medications and risk of pneumonia in acute stroke patients: A systematic review and meta-analysis. J Neurol Sci 2019;400:122-8.

159. Warusevitane A, Karuntilake D, Lally F, et al. The safety and effect of metoclopramide to prevent pneumonia in stroke patients fed via nastrogastric tubes (MAPS trial). Stroke 2015; 46:454-60.

160. Liu C, Shau W, Wu C, et al. Angiotensin-converting enzyme inhibitor/angiotensin II receptor blockers and pneumonia risk among stroke patients. J Hypertension 2012;30:2223-9.

161. Shinohara Y. Antiplatelet cilostazol is effective in the prevention of pneumonia in ischemic stroke patients in the chronic stage. Cerebrovasc Dis 2006;22: 57-60.

162. Kobayashi H, Nakagawa T, Sekizawa K, et al. Levodopa and swallowing reflex. Lancet 1996;348:1320e1.

163. Arai T, Sekizawa K, Yoshimi N, et al. Cabergoline and silent aspiration in elderly patients with stroke. J Am Geriatr Soc 2003;51:1815e6

164. Nakagawa T, Wada H, Sekizawa K, et al. Amantadine and pneumonia. Lancet 1999;353(9159): 1157.

165. Aoki S, Hosomi N, Hirayama J, et al. The multidisciplinary swallowing team approach decreases pneumonia onset in acute stroke patients. PLoS One 2016;11:e0154608.

166. Bath PM, Lee HS, Everton LF. Swallowing therapy for dysphagia in acute and subacute stroke. Cochrane Database Syst Rev 2018;10:Cd000323.

Poststroke Swallowing Rehabilitation and Recent Development

Shu-Fen Sun[1,2], Ping-Hsin Chang[1], Chien-Wei Hsu[2,3], I-Hsiu Liou[1]

[1]Department of Physical Medicine and Rehabilitation, Veterans General Hospital, Kaohsiung;
[2]National Yang-Ming University School of Medicine, Taipei;
[3]Department of Internal Medicine, Veterans General Hospital, Kaohsiung.

Dysphagia is a common poststroke complication. It is associated with aspiration, malnutrition, dehydration, and disability, and it may increase the risk of pneumonia, and even death. Early diagnosis and treatment of patients with dysphagia reduces not only the aforementioned risks, but also the length of hospitalization and overall healthcare expenditures.

Patients with poststroke oropharyngeal dysphagia exhibit highly variable patterns of swallowing abnormalities, and the related symptoms remain challenging to identify clinically. Patients who have experienced stroke should be screened for dysphagia as early as possible on admission and prior to any form of oral intake. Those who fail dysphagia screening or are evaluated to be at risk for dysphagia should be assessed by a speech-language pathologist (or an appropriate professional), where indicated investigation involving instrumental swallowing examinations such as videofluoroscopy or fiberoptic endoscopic evaluation of swallowing should be undertaken to determine the functional severity, understand the swallowing physiology and guide treatments.

Treatment strategies for poststroke oropharyngeal dysphagia include compensatory and rehabilitation strategies. Promising therapies are emerging, including neurostimulation techniques and medication and devices to strengthen the muscles involved in swallowing. The establishment of a multidisciplinary swallowing team approach effectively reduces the risk of pneumonia in patients who have experienced acute stroke. Although swallowing rehabilitation is effective, the management of poststroke dysphagia remains a neglected area of research. More research is needed to determine the optimal management protocols in areas including diagnosis, investigation and treatment. (Tw J Phys Med Rehabil 2021; 49(2):129 - 145)

Key Words: dysphagia, electrical stimulation, stroke, stroke-associated pneumonia, swallowing rehabilitation

Correspondence to: Dr. Shu-Fen Sun, Department of Physical Medicine and Rehabilitation Veterans General Hospital, Kaohsiung, 386, Ta-Chung 1st Road, Kaohsiung 813, Taiwan.
Tel：(07) 3422121 ext. 4210 E-mail：sfsun.tw@yahoo.com.tw doi: 10.6315/TJPMR.202112_49(2).0001