ED crowding is associated with an increased time to pneumonia treatment

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研究背景

- 急診壅塞發現與急診病患的死亡和失能相關
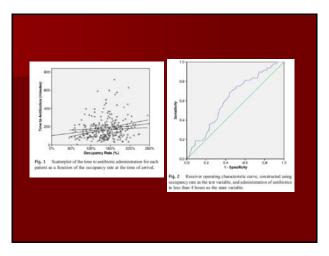 - 延誤AMI病患治療,減少肺炎病患治療品質,轉送延誤,甚至病患至出院皆無法看到醫師

- 想藉此篇討論急診壅塞是否影響到照顧品質來提供額外改善的推動

研究目的

- 探討急診**Occupancy rate** 和 肺炎病患**抗生素給予的時間** 的關係
  - 作者提出正相關的假說

研究方法

- Retrospective review
- Inclusion:18 y/o+, primary diagnosis with pneumonia, for 5 months
- Occupancy rate: ED bed number at 20 min interval
- Spearman correlation between occupancy rate and time to anti administration
- OR of receiveing antibiotics within 4 hr with increasing ED occupancy rate
- Ability of occupancy rate to predict failure of 4-hr goal

研究結果

- Total 334人,僅262人資料完整
- Occupancy rate 20-245%, median 137%(hallway)
- 81%人在4小時內接受到抗生素,median time 150mins

- **Time to antibiotic showed positive correlation with occupancy rate (spearman p=0.17,P 0.008)**
- **ED occupancy rate 增加,減少4小時內抗生素給予(OR 0.31)**
- **Receiver operation characteristic curve area was 0.62**

Fig. 1 Scatterplot of the time to antibiotic administration for each patient as a function of the occupancy rate at the time of arrival.

Fig. 2 Receiver operating characteristic curve, constructed using occupancy rate as the test variable, and administration of antibiotics in less than 4 hours as the state variable.

討論

- 此項研究證實ED crowding 和抗生素給予的時間成正相關
- ED occupancy rate >median會增加4小時以上才給予抗生素的機率
- 不同於先前研究多為urban hospital with CAP ,此篇建立了community hospital analysis 及pneumonia with all etiology
- Limitations: **secondary diagnosis of pneumonia**, **only a single institution**

結論

- 證實ED occupancy和無法在4小時內接受抗生素的關係
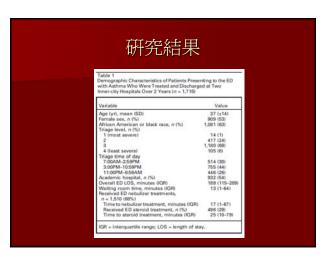- 未來將研究有哪些specific process會被ED crowding影響,才可將barriers remove,改善品質

研究背景

- 近來有許多study討論ED crowding 對 pneuminia,chest pain, and other pain syndrome有著negative impact,但沒有studies 討論asthma病人於ED crowding and length of stay(LOS) 的關係
- Asthma病人可在ED治療和出院,故quality of care 就十分重要
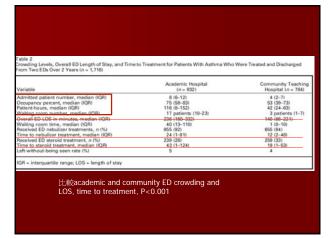

研究目的

- 討論high level ED crowding是否和asthma病人longer LOS 和 longer ED medication order相關

研究方法

- A retrospective cohort study
- 18y/o+ ,ICD-9:asthma,treated and discharged from 2 EDs ,from Jan 2007-2009
- 4 measures of ED crowding(ED occupancy, waiting patients, admitted patients, and patient-hour)
- Analyzing :highest and lowest quartiles using Hodges-Lehmann distances and RR

研究結果

Table 1
Demographic Characteristics of Patients Presenting to the ED with Asthma Who Were Treated and Discharged at Two Inner-city Hospitals Over 2 Years (n = 1,716)

Variable	Value
Age (yr), mean (SD)	37 (±14)
Female sex, n (%)	909 (53)
African American or black race, n (%)	1,081 (63)
Triage level, n (%)	
1 (most severe)	14 (1)
2	417 (24)
3	1,180 (69)
4 (least severe)	105 (6)
Triage time of day	
7:00AM–2:59PM	514 (30)
3:00PM–10:59PM	755 (44)
11:00PM–6:59AM	446 (26)
Academic hospital, n (%)	932 (54)
Overall ED LOS, minutes (IQR)	189 (115–289)
Waiting room time, minutes (IQR)	13 (1–64)
Received ED nebulizer treatments, n = 1,510 (88%)	
Time to nebulizer treatment, minutes (IQR)	17 (1–67)
Received ED steroid treatment, n (%)	498 (29)
Time to steroid treatment, minutes (IQR)	25 (10–79)

IQR = interquartile range; LOS = length of stay.

Table 2
Crowding Levels, Overall ED Length of Stay, and Time to Treatment for Patients With Asthma Who Were Treated and Discharged From Two EDs Over 2 Years (n = 1,716)

Variable	Academic Hospital (n = 932)	Community Teaching Hospital (n = 784)
Admitted patient number, median (IQR)	8 (6–12)	4 (2–7)
Occupancy percent, median (IQR)	75 (58–93)	53 (39–73)
Patient-hours, median (IQR)	116 (8–152)	42 (24–63)
Waiting room number, median (IQR)	17 patients (10–23)	3 patients (1–7)
Overall ED LOS in minutes, median (IQR)	236 (160–332)	140 (86–221)
Waiting room time, median (IQR)	40 (13–110)	1 (0–10)
Received ED nebulizer treatments, n (%)	855 (92)	655 (84)
Time to nebulizer treatment, median (IQR)	24 (1–91)	12 (2–48)
Received ED steroid treatment, n (%)	239 (26)	259 (33)
Time to steroid treatment, median (IQR)	43 (1–124)	19 (1–53)
Left-without-being seen rate (%)	5	4

IQR = interquartile range; LOS = length of stay

比較academic and community ED crowding and LOS, time to treatment, P<0.001

Table 3
Total Treatment and Time to Nebulizer and Steroid Treatment (in Minutes) for Asthma Patients Who Were Treated and Discharged From Two EDs Over 2 Years (n = 1,716)

	Overall ED LOS in Minutes (IQR)			
	Q1	Q2	Q3	Q4
Crowding measures				
Admitted patients*	157 (95–238)	174 (109–275)	214 (128–302)	229 (144–347)
ED occupancy*	144 (88–230)	191 (118–281)	211 (132–309)	228 (144–342)
Patient-hours*	149 (91–239)	176 (110–274)	211 (125–309)	230 (144–332)
Waiting room no.*	151 (88–234)	185 (118–270)	207 (129–297)	243 (140–376)
Time to first nebulizer				
Admitted patients*	17 (2–17)	22 (2–49)	21 (1–97)	26 (2–143)
ED occupancy*	17 (2–40)	17 (1–59)	15 (1–103)	25 (1–126)
Patient-hours*	17 (2–44)	15 (1–59)	19 (1–87)	21 (1–116)
Waiting room no.*	15 (1–42)	18 (2–60)	21 (1–80)	17 (1–155)
Time to steroid				
Admitted patients*	23 (2–47)	24 (0–54)	21 (1–63)	58 (19–142)
ED occupancy*	21 (2–40)	25 (1–25)	43 (2–118)	41 (0–155)
Patient-hours*	19 (0–45)	18 (1–57)	30 (1–114)	54 (7–155)
Waiting room no.*	21 (2–44)	27 (1–94)	22 (0–80)	47 (3–175)

Q1 – Q4 represent the quartiles of each particular crowding measure which Q1 is the least crowded and Q4 is the most crowded.
Each quartile is represents the level of crowding within the individual hospital.
IQR = interquartile range.
*Indicates a significant p-value for the trend at <0.0125.

Combine兩院病人,比較各ED crowding measure,LOS差異, P<0.00125

討論

- High level crowding time 與LOS 和delayed time to order treatment相關
- Little's Law $L = \lambda \times W$

  (L, the level of ED crowding) arrival rate (λ)   (W, ED LOS).
- Multivariable analysis
- delay in treatment 無法完全解釋delay in LOS
- ED crowding affect both valued and nonvalued-added activities

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Limitation:
-only 2 hospital study
-medication order time (not given time)
-severity of illness (triage, not physiologic measures)

結論

- ED crowding 與 longer LOS 相關(more than 1 hour)
- Time to order neubulizer and steroid 僅能解釋一部份,非全部的 longer LOS

Slide 1

Emergency Department Crowding and Time to Care in Patients With Acute Stroke

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Slide 2

研究背景

- ED crowding 常delay許多critical ED service,像是 antibiotic in pneumonia,time to analgesia in severe pain, or CT reading in abd pain
- However, less dramatic effect on severely ill, such as AMI. No studies directly tested ED crowding 對acute stroke care timing的影響

Slide 3

研究目的

- 比較acute stroke <3hr和>3hr 所受ED crowding的影響

Slide 4

研究方法

- A retrospective study
- Acute stroke syndrome patient(ischemic stroke, transient ischemic attack, intracerebral hemorrhage) at 2 hospital(A stoke center and the other was not)
- ED crowding measures: waiting room No. , ED occupancy, admitted patient, total patient hour)
- <3hr compare with >3 hr in time to CT order,compltetion,interpretation, and thrombolysis

Slide 5

研究結果

Table 1. Demographic Characteristics of Patients Presenting to the ED With Symptoms of Stroke to 2 Hospitals (n=506)

Variable	≤3 Hours (n=253)	>3 Hours (n=253)
Age, years, mean±SD	64±17	65±15
Female, no. (%)	131 (52%)	150 (59%)
Black, no. (%)	180 (71%)	192 (76%)
ED ICD-9 diagnosis, no. (%)		
Ischemic	179 (71%)	145 (57%)
Intracerebral hemorrhage	40 (16%)	24 (9%)
Transient Ischemic Attack	34 (13%)	84 (33%)
GCS, mean±SD	13.6±2.8	14.2±2.4
mNIHSS, median (IQR)	5 (1–10)	1 (0–4)
EMS arrival	170 (67%)	104 (41%)
Triage level		
1 (most urgent)	158 (63%)	70 (28%)
2	77 (30%)	144 (57%)
3	15 (6%)	39 (15%)
4 (least urgent)	3 (1%)	0
Intubated	24 (10%)	12 (5%)

Comorbid conditions		
Cancer	29 (12%)	39 (15%)
Congestive heart failure	58 (23%)	49 (19%)
Hypertension	200 (79%)	210 (83%)
Diabetes	80 (32%)	88 (35%)
Prior stroke	64 (25%)	67 (26%)
Triage to CT order, minutes, median (IQR)	7 (2–21)	38 (10–83)
Triage to CT completion, minutes, median (IQR)	30 (18–59)	102 (48–164)
CT completion in 25 minutes	109 (43%)	28 (11%)
Triage to CT interpretation, minutes, median (IQR)	76 (47–122)	151 (89–235)
CT interpretation in 45 minutes, no. (%)	60 (24%)	16 (6%)
Patients receiving tPA, no.	52	0
Triage to tPA, minutes, median (IQR)	73 (48–101)	...
tPA within 60 minutes	21 (40%)	...

ICD indicates International Classification of Diseases, 9th Revision; GCS, Glasgow Coma Scale; EMS, emergency medical services; tPA, tissue plasminogen activator.

比較<3hr和>3hr病患的desmographic character, p<0.001

Slide 6

Table 3. Timing to CT and Compliance With ASA/AHA Standardized Measures in Patients With Stroke Presenting to 2 Hospitals (n=506)

Symptom Onset ≤3 Hours (n=253)	Academic Tertiary Care Hospital (n=199)	Community Teaching Hospital (n=54)
Time to CT order, minutes, median (IQR)	7 (2–17)	8 (2–39)
Time to CT completion, minutes, median (IQR)	26 (15–51)	60 (32–109)
Time to CT read, minutes, median (IQR)	67 (45–111)	109 (72–179)
CT completed ≤25 minutes, no. (%)	96 (48%)	13 (24%)
CT read ≤45 minutes, no. (%)	51 (26%)	9 (17%)
Time to CT order, minutes, median (IQR)	35 (9–79)	52 (21–95)
Time to CT completion, minutes, median (IQR)	91 (38–164)	111 (74–174)
Time to CT read, minutes, median (IQR)	223 (73–236)	181 (123–232)
Patients Who Received Thrombolysis (n=52)	Academic Tertiary Care Hospital (n=49)	Community Teaching Hospital (n=3)
Thrombolysis ≤60 minutes, no. (%)	20 (41%)	1 (33%)

ASA/AHA indicates American Stroke Association/American Heart Association.

Table 2. Crowding Levels That Patients With Stroke Were Exposed to in 2 Hospital EDs (n=506)

Average Crowding Scores	Academic Tertiary Care Hospital (n=398)	Community Teaching Hospital (n=108)
Admitted no., patients, median (IQR)	10 (7–13)	5 (3–6)
Occupancy, median percent (IQR)	78% (63–85%)	79% (58–89%)
Patient-hours, median (IQR)	129 (89–168)	48 (29–75.5)
Waiting room, no. of patients, median (IQR)	11 (6–18)	4 (0–7)

比較兩院之crowding level

Table 4. Relative Risk of Delay in Time to CT Completion and Interpretation in an Academic Tertiary Care Hospital Based on 4 Measures of ED Crowding (n=199)*

	Quartile 1	Quartile 2	Quartile 3	Quartile 4
Time to CT Completion >25 Minutes				
Admitted patient no.	Reference (1.0)	0.8 (0.5–1.1)	0.8 (0.5–1.1)	0.8 (0.6–1.2)
Occupancy rate	Reference (1.0)	0.9 (0.6–1.2)	0.9 (0.7–1.3)	0.8 (0.6–1.2)
Patient-hours	Reference (1.0)	0.9 (0.7–1.3)	0.8 (0.5–1.2)	0.8 (0.5–1.2)
Waiting room no.	Reference (1.0)	0.8 (0.6–1.2)	0.9 (0.6–1.3)	0.8 (0.5–1.2)
Time to CT Interpretation >45 Minutes				
Admitted patient no.	Reference (1.0)	0.8 (0.5–1.4)	0.7 (0.4–1.5)	1.3 (0.7–2.3)
Occupancy rate	Reference (1.0)	0.8 (0.5–1.5)	0.7 (0.4–1.5)	1.4 (0.7–2.5)
Patient-hours	Reference (1.0)	0.8 (0.4–1.8)	1.2 (0.5–2.4)	0.9 (0.4–1.8)
Waiting room no.	Reference (1.0)	1.2 (0.6–2.5)	1.5 (0.7–2.8)	0.8 (0.4–2.0)

*Values represent adjusted ratios for the risk of delay compared to the lowest level of crowding (Quartile 1). Adjusted models control for the time of day, mNIHSS, whether the patient was intubated in the ED, and triage class. Using $P<0.0125$ as significant, none of the resulting risk ratios are significantly different from Quartile 1.

ED crowding與否並沒有對acute stroke sx<3hr造成明顯outcome 不同

- There was no significant association between **ED crowding** and **delays in CT timing or thrombolysis** in patients with symptoms <3 hours.
- Several measures of ED crowding were associated with prolonged times to CT order and completion in patients with symptoms >3 hours

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討論

- 即使high crowding level, the academic hospital 在CT completion and reading 的表現上仍然比較好
  - Stroke team有neurologist,respond immediately
  - CT scanner在ED旁邊(another study reported moving CT scanner to the ED reduced delays to thrombolysis)
- CT completion <25mins (48%), reading<45mins (26%)比例仍太低
  - CT reading 可能被低估,由於都是及時由stroke team判讀
  - 仍有很大進步空間

- Limitation:
- -small sample size
- -retrospectve

結論

1. ED crowding會影響symtoms onset >3 hr病患 CT completion ,但在eligible for thrombolysis 的病患沒有關聯性
2. comprehensive stroke center的stroke care速度上仍然較其他醫院迅速,無關於其ED crowding