

# 수혈의존성 헤모시데린침착증 치료제의 투여경로 변환에 따른 경제성 평가: 주사제와 경구제의 비교

서울대학교 간호대학 간호관리과, <sup>1</sup>보건대학원 보건학과

김진현 · 김윤희<sup>1</sup>

## Economic Evaluation of Iron Chelation Agents: Oral Deferasirox versus Infusional Deferoxamine

Jin Hyun Kim, Ph.D. and Youn Hee Kim<sup>1</sup>

College of Nursing, <sup>1</sup>School of Public Health, Seoul National University, Seoul, Korea

Background: Patients with transfusional iron overload have relied on treatment with deferoxamine, a standard chelating agent. Deferoxamine is administered by intravenous or subcutaneous infusion over an 8–12 hour period 5–7 times per week; however, administration of deferoxamine may lead to poor compliance and reduced quality of life in patients. The use of deferasirox, a once daily oral chelation agent, was recently approved. We conducted an economic evaluation of these two iron-chelating medications in transfusion-dependent patients.

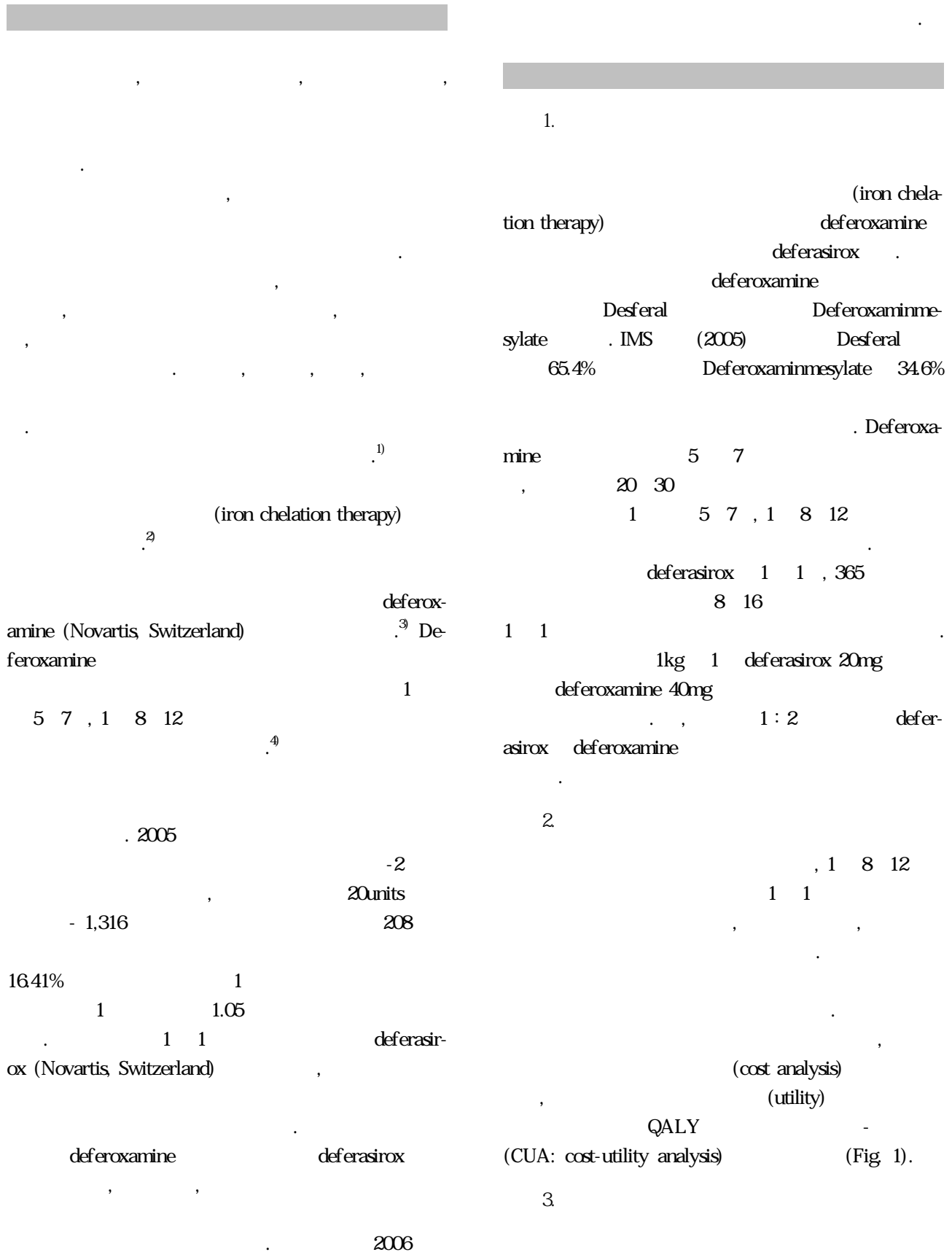
Methods: The efficacy of oral deferasirox and infusion deferoxamine was assumed equal based on clinical trials of non-inferiority with the administration of 20mg/kg/day deferasirox versus 40mg/kg/day deferoxamine. Depending on the methods utilized for measuring administration time, travel time and convenience between the use of infusion and oral therapy, either cost analysis or cost-utility analysis was undertaken, respectively. Cost analysis included determination of direct medical costs (drug costs and administration costs), non-medical costs (travel costs), and indirect costs (productivity loss associated medical utilization). For cost utility analysis, the cost per QALYs (quality-adjusted life years) was calculated based on costs subtracting indirect costs (productivity loss) and gains of QALYs between the two agents. Results: Deferasirox therapy resulted in a cost savings per patient of 23,471,777 Korean won based on cost analysis. Based on cost utility analysis, the cost per QALYs gained was – 398,576 Korean won (4,527,819 Korean won savings with a gain of 11.5 QALYs per patient).

Conclusion: The results of cost analysis and cost utility analysis of the use of oral deferasirox versus infusion deferoxamine showed that deferasirox is a more economical and potentially socially beneficial iron-chelating agent in Korea. (*Korean J Hematol* 2008;43:89-97.)

Key Words: Deferasirox, Deferoxamine, Iron chelating agents, Cost analysis, Cost utility analysis

: 2008 3 31 , : 2008 6 20  
: 2008 6 23  
: , 28  
151-744,  
Tel: 02-740-8818, Fax: 02-766-1852  
E-mail: jinhyun@snu.ac.kr

Correspondence to : Jin Hyun Kim, Ph.D.  
College of Nursing, Seoul National University  
28, Yoengon-dong, Jongno-gu, Seoul 151-744, Korea  
Tel: +82-2-740-8818, Fax: +82-2-766-1852  
E-mail: jinhyun@snu.ac.kr



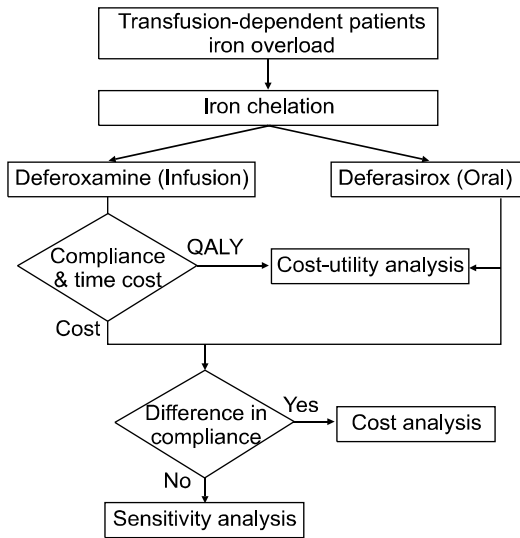


Fig. 1. The structure of economic evaluation.

Table 1. Comparison of available iron chelators

Parameter	DFO	DSX
Dosages (based on 50kg)	2,000mg	1,000mg
Utility value	0.61	0.85
QALYs	28.85	40.21
Costs	10,959 Won /500mg	27,462 Won /500mg

Abbreviations: DFO, deferoxamine; DSX, deferasirox; QALYs, quality-adjusted life years.

50kg 1  
 deferoxamine 2,000mg , deferasirox  
 1,000mg ( 500mg× 2 )  
 1.356  
 deferasirox ,  
 1.3  
 de-  
 ferasirox deferoxamine  
 ,  
 deferasirox deferoxamine  
 56 (perfect health)  
 1.00 TTO (time trade-off)  
 deferoxamine  
 de-  
 deferasirox 0.85, deferox-  
 amine 0.61  
 7.  
 deferoxamine  
 5 ( 260 ), deferasirox 7  
 100%  
 Gabuti Piga<sup>2</sup>  
 260 47.3  
 deferasirox 7  
 Gabuti and Piga (1996) deferox-

amine 300 365  
 57  
 deferoxamine 5 , deferasirox  
 7  
 5 deferoxamine  
 ,  
 deferasirox  
 (QALY) 40.21 , deferoxamine (QALY)  
 28.85  
 4  
 Table 1  
 Deferoxamine desferal 500mg 11,293

Deferoxaminmesylate 500mg 10,328					3
ferasirox	10,959	(Exjade)	2007 1	55%	
	2006 12	2007 1			1
2007 1			(Exjade) 500		3
mg 27,462	deferasirox				3
feroxamine					
	(500mL× 2 )			3	30%
IV Side Injection,					1
fusion pump				2,000	
	500mL				2006
oxamine	5			2,686,512	45
	5				
			1		
4					
Deferasirox					
	1				
				1.	
				Deferoxamine	50kg
(liver iron concentration)				deferoxamine 1	2,000mg
				500mg	1
	50kg			4	deferasirox
				1 500mg 2	
2006				Deferoxamine	1

Table 2. Costs of DFO and DSX (Unit: Won)

Cost	DFO		DSX	
	Daily	Year	Daily	Year
Direct cost				
Established patient	18,337	2,183,818	18,337	220,038
Day care	30,530	7,937,800	-	-
Intravenous infusion (500mL×2)	4,784	1,243,840	-	-
IV side injection (inpatient)	2,314	606,640	-	-
Infusion pump (once a day)	1,642	427,025	-	-
5% glucose (500mL×2 vial)	1,952	507,520	-	-
Drug	43,836	11,397,474	54,924	20,047,260
Travel cost	2,000	520,000	2,000	24,000
Subtotal	105,395	24,819,117	75,261	20,291,298
Indirect cost				
Travel time cost (2 hours)	14,708	3,824,091	14,708	176,496
Infusional time cost (8 hr/day)	58,832	15,296,363	0	0
Subtotal	73,540	19,120,454	14,708	176,496
Total Cost	178,936	43,939,571	89,969	20,467,794

Abbreviations: DFO, deferoxamine; DSX, deferasirox.

**Table 3.** Results of cost analysis and cost-utility analysis

		DFO	DSX	Difference
Cost	Total cost (Won)	43,939,571	20,467,794	- 23,471,777
Effectiveness	LYG	47.3	47.3	0
Cost analysis	Net cost			- 23,471,777
Cost	Direct cost (Won)	24,819,117	20,291,298	- 4,527,819
Utility	QALYs	28.85	40.21	11.35
Cost-utility	ACUR	860,281	504,633	- 355,648
	ICUR			- 398,576

Abbreviations: DFO, deferoxamine; DSX, deferasirox; LYG, life-years gained; QALYs, quality-adjusted life years; ACUR, average cost-utility ratio; ICUR, incremental cost-utility ratio.

10 5 , 7 4 17 asirox QALYs 40.21 (=47.3× 0.85)  
 9 , 1 260 , deferasirox deferoxamine  
 ( 5 ) 2 482 11.35 de-  
 , 1 912 4 feroxamine deferasirox ICUR (incremental cost-  
 394 . 1 4 3 utility ratio) - 398,856 defe-  
 836 , 1 139 7 . de- asirox  
 ferasirox 1 9 7 5 (dominant)  
 , 1 5 365 3  
 2 47  
 2 29 , deferoxamine deferasirox  
 18 (Table 2).  
 deferoxamine deferasirox 1.8  
 . Gabuti Piga<sup>2</sup>  
 , ( ) 47.3  
 . Deferoxamine 5  
 43,939,571 , deferasirox DFO  
 20,467,794 , deferasirox deferoxamine , 75 12.5 , 75 225  
 23,471,777 (Table 3). 28.4 , 225 300 47.3 ,  
 2 - 300 57 .  
 deferoxamine 58% 260  
 70% 42% 70%  
 2) 70%  
 (uniformly distribution)  
 (CUA) Table 3 64% . Fischer <sup>11)</sup>  
 . deferoxamine (deferiprone)<sup>4</sup>  
 24,819,117 , deferasirox deferoxamine 16%  
 20,291,298 deferoxamine . Deferiprone  
 deferasirox 4,527,819 . deferasirox  
 .  
 deferox- 74%  
 amine QALYs 28.85 (=47.3× 0.61), defer-

**Table 4.** LYG according to the compliance with DFO and DSX

Number of infusions	LYG	DFO	DSX
0 75 infusions/yr	12.5		
76 225 infusions/yr	28.4	166 infusions/yr (64%)	
225 300 infusions/yr	47.3		271 infusions/yr (74.24%)
>301 infusions/yr	57		308 infusions/yr (84.48%)

Abbreviations: DFO, deferoxamine; DSX, deferasirox; LYG, life-year gained; ( ), compliance rate.

**Table 5.** Sensitivity analysis for compliance with DFO and DSX: ICER (Unit: Won/LYG)

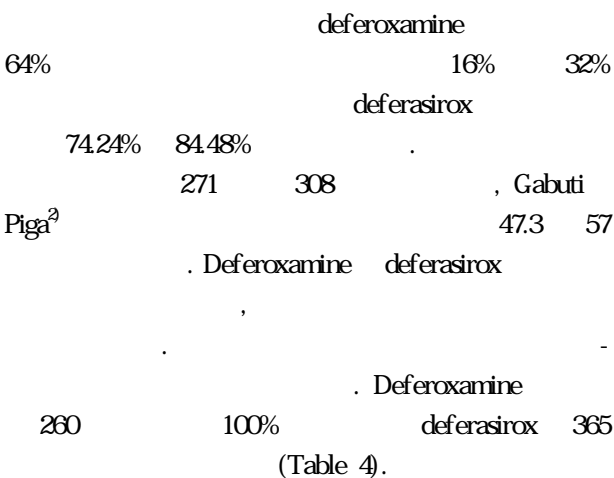
	Compliance with DSX	
	74% (271 days) (LYG: 47.3)	84% (308 days) (LYG: 57)
Compliance with DFO 64% (166 infusions) (LYG: 28.4)	- 683,917	- 378,676

Abbreviations: DFO, deferoxamine; DSX, deferasirox; LYG, life-year gained.

**Table 6.** Sensitivity analysis for compliance with DFO and DSX: ICUR (Unit: Won/QALY)

	Compliance with DSX	
	74% (271 days) (QALYs: 40.2)	84% (308 days) (QALYs: 48.5)
Compliance with DFO 64% (166 infusions) (QALYs: 17.3)	- 35,837	40,412

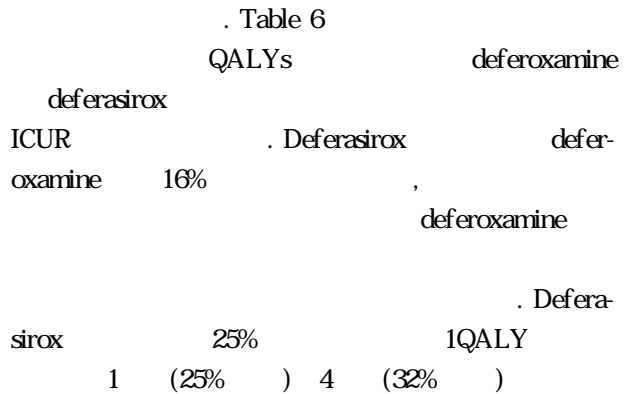
Abbreviations: DFO, deferoxamine; DSX, deferasirox; QALYs, quality-adjusted life years; ACUR, average cost-utility ratio.



**Table 5** deferoxamine deferasirox (LYG)

	deferoxamine	deferasirox	ICER (incremental cost-effectiveness ratio)
16%	ICER - 683,917	LYG	
32%		- 378,676	(LYG)

ICER 0  
deferoxamine deferasirox



Deferoxamine  
deferasirox  
Deferoxamine

Deferoxamine  
Deferoxamine

65%  
 , 28% , 25%  
 , 22%  
 )  
 ,  
 23%, 15%, 9%  
 xamine

deferoxamine 95%  
 100% ( 260  
 61%  
 . Defero-

10

11)

deferoxamine  
 .  
 deferiprone  
 deferox-  
 amine  
 deferasirox

Markov

Delea<sup>9</sup> deferoxamine  
 28,255 /QALY(≡ 2,600  
 . 1QALY  
 1QALY  
 50,000 100,000 (≡ 4,600 9,200 )  
 deferasirox -  
 defer-  
 oxamine deferasirox 1 : 1.25  
 ( )

deferasirox deferox-  
 amine  
 deferasirox  
 deferoxamine  
 deferox-  
 amine 1.4  
 0.8  
 deferasirox deferoxamine  
 deferoxamine  
 deferasirox

deferoxamine  
 deferasirox

Sharma<sup>15</sup>

(inflammatory bowel dis-  
 ease),  
 1  
 (印度)

(anaphylactic shock)

Rossini<sup>13</sup>

(bisphosphonate)  
 (clodronate)

30

. Varsano<sup>14</sup>

1





- 
- of a randomized open-label phase II trial. *Acta Haematol* 2008;119:133-41.
- 7) Osborne RH, De Abreu Lourenco R, Dalton A, et al. Quality of life related to oral versus subcutaneous iron chelation: a time trade-off study. *Value in Health* 2007;10:451-6.
  - 8) Fischer R, Longo F, Nielsen P, Engelhardt R, Hider RC, Piga A. Monitoring long-term efficacy of iron chelation therapy by deferiprone and desferrioxamine in patients with beta-thalassaemia major: application of SQUID biomagnetic liver susceptometry. *Br J Haematol* 2003;121:938-48.
  - 9) Delea TE, Sofrygin O, Thomas SK, Baladi JF, Phatak PD, Coates TD. Cost effectiveness of once-daily oral chelation therapy with deferasirox versus infusional deferoxamine in transfusion-dependent thalassaemia patients: US healthcare system perspective. *Pharmacoeconomics* 2007;25:329-42.
  - 10) Canatan D, Temimhan N, Dincer N, Ozsancak A, Oğuz N, Temimhan M. Continuous desferoxamine infusion by an infusor in thalassaemia major. *Acta Paediatr* 1999;88:550-2.
  - 11) Chan GC, Ng DM, Fong DY, Ha SY, Lau YL. Comparison of subcutaneous infusion needles for transfusion-dependent thalassaemia patients by the intrapersonal cross-over assessment model. *Am J Hematol* 2004;76:398-404.
  - 12) Sharma JB, Jain S, Mallika V, et al. A prospective, partially randomized study of pregnancy outcomes and hematologic responses to oral and intramuscular iron treatment in moderately anemic pregnant women. *Am J Clin Nutr* 2004;79:116-22.
  - 13) Rossini M, Braga V, Gatti D, Gerardi D, Zamberlan N, Adami S. Intramuscular clodronate therapy in postmenopausal osteoporosis. *Bone* 1999;24:125-9.
  - 14) Varsano I, Volovitz B, Horev Z, et al. Intramuscular ceftriaxone compared with oral amoxicillin-clavulanate for treatment of acute otitis media in children. *Eur J Pediatr* 1997;156:858.
  - 15) Jundt JW, Browne BA, Fiocco GP, Steele AD, Mock D. A comparison of low dose methotrexate bioavailability: oral solution, oral tablet, subcutaneous and intramuscular dosing. *J Rheumatol* 1993;20:1845-9.