

Deep Venous Thrombosis and Pulmonary Embolism

Superficial and deep thrombophlebitis, phlebothrombosis, septic thrombophlebitis and thrombosis, pulmonary embolism thromboembolic disease(TED,)
postpartum maternal mortality
(Atrash et al., 1992),

2 () ,
,

INCIDENCE AND PATHOPHYSIOLOGY

1. Incidence

bophlebitis가 , throm-
bosis가 , thromboembolism 1000
0.5-3 , 0.24%
(Bonnar J, 1981)
postpartum ,
hospitalization (Barbour and Pickard, 1995), lactation high-dose estrogen
postpartum event . Pulmo-
nary embolism deep venous thrombosis
(DVT) , DVT가
24% (15-25%)
pulmonary embolism , mortality rate
15% (Wessler, 1976a),
embolism 4.5% 1%(0.7%)
(Vilasanta, 1965).

thromboembolic disease Table 1
(Weiner CP, 1982).

Table 1. Incidence of thromboembolic disease in Obstetrics

Type of TED	Incidence(%)
Superficial Thrombophlebitis(lower extremity only)	
Antepartum	0.016 - 0.15
Postpartum	0.08 - 1.35
DVT	
Antepartum	0.11 - 0.36
Postpartum	0.15 - 0.27- 3.0
Pumonary embolism	
Postpartum	0.04 - 0.05

2. Pathophysiology

Virchow vessel wall injury, stasis, local
clotting factor intravascular coagulation
가
endothelium throm-
bosis가
vein distensibility가 가 (McCausland et al., 1961),
lower extremity venous flow
가 , uterus가 venous return
(Wright et al, 1950). stasis 가
preeclamsia, threatened abortion, premature labor
(prolonged bed rest) 가
fibrinogen, factor VIII, Vitamin
K-dependant clotting factor가 가 (Todd et al 1965),
circulating plasminogen activator가
fibrinolytic activity가 (Nilsson and
Kullander, 1967), platelet, factorXI, XIII ,
bleeding time clotting time pregnancy
(Berge et al.,1993). “
(hypercoagulable state)” ,
thromboembolism 가

Cesarean section (9 3-5 가),
instrument delivery, advanced maternal age, increased parity,
estrogen lactation suppression

가, Rickles and Edwards(1983) vari-
cosities, trauma or infection, obesity, O blood type,
congestive heart failure, dehydration, shock, disseminate
cancer, dysproteinemia, polycythemia vera, anemia (sickle cell type)

thromboembolism

가

thrombotic event history, lupus anticoagulant
, antithrombin III deficiency(1/3500 DVT), protein C
deficiency(25% DVT), protein S deficiency, plasminogen
congenital defect thromboembolic event

(Mueh et al., 1980; Taberino et al., 1991).

thromboembolism

1.8

, 5.5 가

(Hathaway and Bonnar, 1987).

maternal age 가 pulmonary embolism 가
가 .

DIAGNOSIS

thromboembolism . throm-
boembolisms (anticoagulation)

thromboembolism

1. Deep Venous Thrombosis()

1)

가

(muscle pain), (palpable
deep linear cord), (Tenderness), (swelling),
Homans sign, (dilated superficial veins)

, 가 2cm

가 . 가
(dorsiflexion)
Homan's sign .

, 45%

(Cranley et al., 1976).

10% (Coon, 1976).

, (septic pelvic thrombo-
phlebitis) 가

가 (Duff and

Gibbs, 1978),
48-72

2)

DVT

Impedance plethysmography(),

가)

(proximal vein)

(Cronan, 1991). 5MHz

(venous occlusion)

가 . 가, transducer

가

(Lensing et al., 1989). (popliteal vein)

(femoral vein) 가

91%, 99% (Polak et al., 1991), calf vein

thrombosis 36%, 95%

doppler flow

가 ,

impedance plethysmography

(Heijboer et al., 1993).

(Venography).

가 , ,

, pelvic venous plexus

, contrast material

가

가

) Impedance plethysmography.

Thigh cuff (venous return)

, (calf) (venous
volume) 가 , cuff 가

. venous obstruction

outflow 가 ,

(Toy and

Schrier, 1978). Ginsberg (1989) doppler ultrasound
impedance plethysmography

proximal DVT

), pulmonary embolism
11.5% PaO₂ 80-90mmHg
(Sasahara, 1983) PaO₂ 90mmHg
Fibrinopeptide A fibrin degradation product, D-dimer
DVT

2. Pulmonary embolism()

1)

pulmonary embolism

Table 2

Table 2. Signs and Symptoms of pulmonary embolism

Tachypnea	89%
Dyspnea	81%
Pleuritic pain	72%
Apprehension	59%
Cough	54%
Tachycardia	43%
Hemoptysis	34%
Temperature > 37	34%

emboli, emboli
lodged cough, hemoptysis, splinting
pleuritic chest pain, friction rub pleural sign
infarction uterine
enlargement leg discomfort breath shortness
가, multiple small emboli
, multiple small emboli major
embolus . Pulmonary arterial
circulation 50% massive pulmonary
embolism hypotension syncope, convulsion
myocardial infarction ,
jugular venous distention right heart failure,
enlarged liver, left parasternal heave, fixed splitting of the
second heart sound가 . Physical examination
tachycardia atelectatic rales

2)

가) Electrocardiogram

ECG 90%가 ,
nonspecific T-wave inversion 40% , strain pattern
(S1Q3T3) 가 classic right axis shift가 extensive
embolization . tachycardia가 가

) Lung scanning & pulmonary arteriography
PaO₂ sign & symptom
lung scan
가 6 99mTc , 1
millicurie(mCi) 2 mrad
perfusion scan
133Xe(5.3 ,
10-20 mCi dosage), 127Xe(36.43 , 5-10 mCi
dosage), 125I(8.1 , 0.3mCi dosage), 127I(60.2
, 0.1- 0.3mCi dosage)
pulmonary embolus 가 scan
. Pulmonary embolism
ventilation lung scan specificity

Acute pulmonary embolism 900
prospective study
embolism V/Q
scan(high, intermediate, or low probability)
(PIOPED, 1990). V/Q scan sensitivity 41% (high-
probability scan) - 98%(low-, intermediate or
high-probability scan) , specificity 97%-10%
. Pulmonary embolism
, pulmonary arteriography .

) Other laboratory studies

Gadolinium magnetic resonance angiography
(MRA) (Meaney et al, 1997),
(Fibrin split products)

가
(Hirsch, 1981). 가
III, C, S, V Leiden(Mackie et al., 1978;
Griffin et al., 1981; Comp and Esmon, 1984; Rosendaal, 1997)
, lupus anticoagulant
(Hallak et al., 1997).

MANAGEMENT

(pulmonary embolism) ,
(anticoagula-

) Arterial PaO₂
80mmHg PaO₂ pulmonary embolism

tion therapy)

1. Deep venous thrombosis
 bed rest , Trendelenburg
 position , foot board flexion
 extension ,
 ambulation venous stasis .
 moist heating elastic
 stocking . 가
 anticoagulants platelet function
 (e.g. aspirin) , anti-inflammatory drug .

2. Pulmonary Embolism
 embolus 가 .
 , 가
 , 가 maternal hypoxia damage
 , maternal PaO₂ 70 mmHg

Pulmonary edema가 positive pressure
 가 , meperidine morphine pain apprehen-
 sion . Bed rest 5-7
 , stool softer가 .
 Shock mean arterial pressure pulmonary vasculature
 flow isoproterenol dopamine
 , Swan-Ganz catheter
 monitoring pulmonary artery wedge pressure
 . reflex vasospasm , pulmo-
 nary edema가 diuretic action
 aminophylline , digoxin heart failure가
 , . Septic
 embolus가 antibiotics .

ANTICOAGULATION

coagulation process , 3
 가 type therapeutic agents가 thrombosis
 . platelet adhesion aggre-
 gation agents, fibrin formation

agents, clot lysis agents .
 Proximal DVT anticoagulation
 , popliteal fossa level thrombosis
 . Lower leg DVTs 20%가
 proximally heparin spread
 가
 (Bentley et al., 1980). Extension
 doppler flow studies
 impedance plethysmography가 .
 , proximal extension
 anticoagulation risks , fibrin formation
 agents, coumarin derivatives가 thromboem-
 bolism 가 . Heparin thromboem-
 bolism ,
 coumarin derivative .

1. Heparin
 Heparin mast cells
 , mucopolysaccharide organic base , thrombin potent
 inhibitor(fibrinogen fibrin)가
 activated factor X(Xa) inhibitor
 (Rosenberg, 1987) 가 antithrombin III
 (AT-III) alpha-globulin . Heparin
 antiplatelet effect 가 fibrinolysis
 lyse thrombi
 (Wessler and Gitel, 1979). Heparin 3,000-30,000(mean
 15,000) molecular weights 가 heterogeneous ,
 size negative charge placenta
 , breast milk .
 heparin effect heparin 100unit
 protamine sulfate 1mg .
 (constant infusion ,
 heparin 2).
 Protamine 가 bleeding 10
 50mg .
 Heparin venous thromboembolism
 initiation propagation . 3가

Table 3. Dosage Adjustments For Continuous Heparin Infusion

aPTT(sec)	Bolus(U/kg)	Hold infusion(min)	Rate change(U/hr)	Repeat aPTT(hr)
< 50	70	0	+200	4 - 5
50 - 59	0	0	+100	4 - 5
60 - 80	0	0	0	next A.M.
81 - 99	0	0	-100	4 - 5
> 100	0	60	-200	4 - 5

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dosage ranges가	(Table 3).	) Prophylactic Dose Therapy()
가) Therapeutic Dose Therapy.		heparin factor
anticoagulation 11-15		Xa(activated factor X) 가
가 , Optimal anticoagulation aPTT 1.5-2.5		, heparin factor Xa major inhibitors
(60-80seconds) . Spontaneous hemorrhage		(AT-III) 가 , factor Xa
aPTT가 12 hours 135 seconds .		thrombin
Heparin complete blood count(CBC), platelet count,		heparin .
prothrombin time(PT), aPTT, urinalysis 가		12 heparin 5000U ,
, platelet count가 50×10^3 /liter		aPTT .
heparin . Pulmonary		, ,
embolus가 initial loading dose 150units/kg		가 .
, uncomplicated DVT 가 loading dose		가 .
100units/kg heparin 15		heparin ,
. Initial loading dose initial infusion rate		, (
15-25units/kg/hour , loading dose 4		가)
dosage change aPTT , steady		. , , 4 6
state aPTT .		, , 4 6
Heparin infusion 5% dextrose 250ml		. ,
15,000units of heparin 60units/ml		4 6
. Recent bleeding, bleeding		heparin
hematologic disorders, previous antithrombotic therapy, 10		, warfarin
surgery circulating heparin level		. Heparin 4%
. Continuous intravenous heparin active thromboembolic		, 6 15,000U/day calcium ,
disease 가		osteoporosis(17%) D .
3-5 . anticoa-		, , ,
gulation , heparin warfarin		, (3%) .
. Warfarin		. heparin dependent IgG antiplatelet antibody ,
, heparin ,		heparin 가 , Lower-
가 ,		molecular-weight heparin(LMWH) .
2 3 8 12		heparin
aPTT 1		3
. 4 6		가 .
4 6		) Lower-Molecular-Weight Heparin.
6 12 .		LMWH .
, iliofemoral venous thrombosis,		LMWH
6		molecule . molecule 18
, heparin 12 ,		saccharide moieties (MW < 5400) AT-III
aPTT가 6 1.5 (40 60)		thrombin . AT-III
. warfarin .		factor Xa catalyze()

thrombin 가 . 가 .
 LMWH standard heparin 3-20mg/day . 5-7
 PT가 monitoring 1-2
 가 LMWH 가 2 , 1
 가 . Warfarin 5-7
 가 PT 2-4
 가 PT가
 2.5 ,
 2. Coumarin Agents 가 Coumarin
 sodium warfarin(Coumadin) 가 salicylate, phenothiazine,
 K , ethyl alcohol,
 K warfarin
 factor VII, factor IX, factor X prothrombin
 cofactor .
 warfarin 44 (Wessler
 and Gitel, 1984).
 3
 warfarin 1 14 . (Pridmore et al., 1975).
 (4 8) 가 warfarin
 condrodysplasia punctata ,
 K
 K3 5mg
 stipping, , (), prothrombin time 6
 Warfarin 2, 3 . (, 25-50mg)
 , bifrontal narrowing, PT 가
 birth defect . 1 10 2 (refractory) .
 warfarin K K가 가
 2, 3 가 2, 3 warfarin 가 (Hirsh et al., 1972).
 가 1mg K ,
 가 , 35
 coumarin K antagonist ,
 (fresh frozen plasma) 5ml/kg가 .
 Warfarin 가 factor IX X
 factor VII 가 , heparin wafarin 가 . Lee (1986)
 warfarin factor VII heparin 3
 (가 6) 3 , warfarin
 .
 PT . warfarin .
 10-15mg/day . DVT , warfarin (,) heparin
 in situ (International
 Normalized Ratio) 2.0-3.0 . 3 (,
 INR 3.0-4.5)
 thromboplastin .
 PT INR
 potency

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3. , , (,) , heparin .
 heparin ,) (antiplatelet agents)
 aPTT 1-1.5 (arterial embolism)
 가 , episiotomy 가 ,
 가, uterine atonia retained placenta 가
 (Pridmore et al., 1975).
 (conduction anaesthesia) .
 heparin 6) (surgical intervention)
 , 5-7 , warfarin
 가 ,
 4-6 .
 8 가
 (Lee et al., 1986).
 warfarin ,
 (De Swiet and Lewis, 1977; Orme et al., 1977).
 K ,
 (Bramel and Hunter, 1950; Illingworth and Finch, 1959).
 25
 10 .

4. Alternative therapy()
 가) (fibrinolytic agents)
 ,
 fibrinolytic agents (streptokinase, SK) (Urokinase, UK) plasmin
 formation 가 (clot lysis)
 가 (Porter and Goodnight, 1977). DVT , SK
 30-50% , SK UK
 (Urokinase
 Pulmonary Embolism Trial, 1970, 1974).

single chain urokinase 3 polyethylene
 glycol -derived, antibody-directed, tailor-made recombinant
 forms, hybrid complexes 가 .
 ,
 Dextran 가
 heparin 가 .
 (thrombectomy) plegmasia cerulea
 dolens gangrene
 ,
 가 iliofemoral
 thrombosis, , embolectomy
 vena caval interruption intracaval device
 .
 (inferior vena cava ligation), plication,
 clipping umbrella
 .
 heparin 10%
 .
 (bilateral ligation of femoral veins)
 iliacs 가 pelvic & gluteal
 .
 (ligation of left ovarian vein) .
 (pulmonary embolectomy)

SPECIAL PROBLEMS

1. Ovarian hemonahge during anticoagulation therapy

UK , SK .
 2 tissue plasminogen
 activator(tPA), acylated plasminogen, SK activator complex,

3-6
 heparin coumarin
 . Fibrinopeptide A 12ng/ml SPT

2. Septic pelvic thrombophlebitis (SPT)
 SPT 0.1% , 가
 endometritis 31-39% septic pulmonary embolism

3. Ovarian vein thrombosis()
 4000 1
 . 80%
 , 2-3
 () , ,
 가 50% . obstruction
 , 10-15 heparin 가 ,
 CAT(computerized axial tomography) scan
 , obstruction .

heparin
 12-36
 heparin