



# Validation of a Preoperative Risk Model for Pneumonia in Patients undergoing CABG Surgery

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**Abstract**

**Background:** Postoperative pulmonary complications (PPCs) are among the most frequently reported complications of Coronary Artery Bypass Graft (CABG) surgery. However, the risk to develop a PPC is not the same for all patients. The aim of this study was to identify preoperative patients at risk of developing pneumonia undergoing CABG surgery.

**Keywords:** 5LVN VWUDWLILFDWLRQ 3QHXRZKUDWK&\$%DVVXGLHFDGH VHYHUDO UL 3K\VLRWKHU D\ (XUR6&25( 676 DQG 8. %D\HV KDYH EHHQ WHUP PRUWDOLW\ DIWHU DFFRXQWLQJ IR > @ ,Q FDUGLDF VXUJHU\ VKRUW XVHG DV D PHDVXU RI SHUIRUPDQFH > 1XPHURXV VWXGLHV KDYH DWWHPSW SXO PRQ DLGHRV SO LFDWL RQ FWRU & VIRDUH SDWLHQWV XQGHUJRLQJ FDUGLDF VXUJHUV PLQ @ QWRZLQRV VLKH O LFRWLV DQG LPSRUWDQW WR SDWLHQWV WR GHWHUPLQH & ZKHWKKHU WOH WKHU IR ILVXD JHHGL SHUVRQDOO\ DFFHSWDEOH WR WKHP 6 XDGZHL JKHSGHRS HURZLWK HUSDWLHDFWRU IDFWRUV WR GHWHUPLQH ZKHWKKHU & SDWLHQWV HGH W R D Q Q C S I U R S U S % \* W V X U J H U L Q W H U Y H Q W L R Q D Q G W R D O H U W S K \ V L F L D Q V W R W K R V H S D W L H Q W V Z K R P D \ Q H D G G L W L R Q D O F D U H R U P R Q L W R U L Q J 5 L V N D Q G U L V N W K R V H V W X G A Z D V W R Y D O L S U H R S H J D W Y H I U L F N P R G L O J R X W F R P H V & \$ % \* V X W H U L D G M W R W K S V R Z L W N D K B K I F S U R Y L G L Q J D Q R S S R U W X Q L W \ W R D V V H G H Y F L Q R S L Q J 3 3 & V L V N Q S D W L W L H G R U X S P H X P H R I S D W L H Q W V D W K L J K U L V N R I G H Y H O R S L F O L Q L F L D Q V W R G L U H F W S U H R S H U D W L Y H W R Z D U G V W K R V H W K D W P L J K W E H Q H I L W P R

3DWLHQWV DQG 0HWKRGV

3DWLHQWV

'DWD ZHUH FROOHFWHG IURP SDWLHQWV ZKR XQGHUZHQW HOHFWLYH &\$%\*  
VXUJHU\ EHWZHHQ -XO\ DQG 6HSWHPEHU LQ WKH 'HSDUWPHQW RI  
&DUGLDF 6XUJHU\ 8QLYHUVLW\ 0HGLFDO &HQWHU 80& 8WUHFkw 7KH  
1HWKHUODQGV 7KH SURWRFRQ QXPEHU ( ZDV DSSURYHG E\ WKH  
,QVWLWXWLRQDO 5HYLHZ %RDUG DQG (WKLFV &RPPLWWHH 3DWLHQWV VFKHGxOH  
IRU SULPDU\ HOHFWLYH &\$%\* ZKR KDG WKH DELOLW\ WR XQGHUVWDQG  
LQIRUPHG FRQVHQW ZHUH HOLJLEOH ([FOXVLRQ FULWHULD ZHUH D KLVWRU\ RI  
FHUHEURYDVFXODU DFFLGHQW XVH RI LPPXQRVXSSUHVVLYH PHGLFDWLRQ IRU  
GD\V SULRU WR VXUJHU\ SUHVHQFH RI D QHXURPXVFXODU GLVRUGHU DQG D  
KLVWRU\ RI SXOPRQDU\ VXUJHU\ FDUGLRYDVFXODU LQVWDELOLW\ RU DQHXU\VP  
:ULWWHQ LQIRUPHG FRQVHQW ZDV REWDLQH G IURP DOO SDUWLFLSDQWV

2Q WKH EDVLV RI WKH ULVN PRGHO > @ WKH VL[ IDFWRUV ZHUH VFRUH G  
SUHRSHUDWLYHO\ WR GHWHUPLQH D SDWLHQWdV ULVN RI GHYHORSLQJ SQHXPRQ  
DJH \HDUV DQG SURGXFWLYH FRXJK HDFK VFRUH G SRLQWV VPRNLQJ  
DQG GLDEHWHV PHOOLWXV HDFK VFRUH G SRLQWV DQG LQVSLUDWRU\ YLWDO  
FDSDFLW\ ,9& DQG PD[LXP H[SULPWRU\ PRXWK SUHVXUH 3

SUHGLFWHG ERWK DUH SURWHFWLYH IDFWRUV HDFK VFRUH G SRLQWV 7KHVH  
VL[ IDFWRUV ZHUH DGGHG WR \LHOG D WRWDO ULVN VFRUH UDQJLQJ EHWZHHQ  
DQG SRLQWV 7KH VXJJHVWHG FXW RII YDOXH IRU KLJK ULVN LV D VFRUH  
> @

'DWD FROOHFWLRQ

'HPRJUDSKLFV DQG SUHRSHUDWLYH ULVN IDFWRUV ZHUH SURVSHFWLYHO\

VXFK DV D FRLQ IOLS DQG DQ \$8& RI UHIOHFWV SHUIHFW GLVFULPLQDWLRQ  
 ZLWKRXX DQ\ IDOVH SRVLWLYH DQG IDOVH QHJDWLYH UHVXOWV > @

### 5HVXOWV

#### 3DWLHQWV

\$ WRWDO RI FRQVHFXWLYH SDWLHQWV XQGHUZHQW ILUVW WLPH HOHFWLYH  
 &\$%\* VXUJHU\ LQ WKH 8QLYHUVLW\ 0HGLFDO &HQWHU 8WUHFKW WKH  
 1HWKHUODQGV 7KLUW\ VHYHQ SDWLHQWV ZHUH H[FOXGHG SDWLHQWV GLG QR  
 XQGHUVWDQG 'XWFK KDG XQGHUJRQH DQ HPHUJHQF\ SURFHGXUH KDG  
 XQGHUJRQH SHUFXWDQHRXV WUDQVOXPLQDO FRURQDU\ DQJLRSODVW\ DQG  
 SDWLHQWV GLHG SDWLHQWV GLHG EHIRUH VXUJHU\ GXH WR FDUGLDF UHDVROV  
 GLHG DIWHU VXUJHU\ GXH WR RQ UHVSLUDWRU\ IDLOXUH DV D FRQVHTXHGH RI  
 SQHXPRQLD DQG GLHG DIWHU VXUJHU\ GXH WR FDUGLDF IDLOXUH 7KH  
 UHPDLQLQJ SDWLHQWV ZHUH DYDLODEOH IRU WKH VWXG\ RI ZKR  
 GHYHORSHG SQHXPRQLD 7DEOH OLVWV WKH FKDUDFWHULVWLFV RI SDWLHQWV  
 DFFRUGLQJ WR SRVWRSHUDWLYH SQHXPRQLD VWDWXV

| Characteristics   | Patients with Pneumonia (N= 28; 6.7%) | Patients without Pneumonia (N= 393; 93.3%) | OR    | 95% CI       | P    |
|---|---------------------------------------|--|-------|--------------|------|
| Age, mean (SD), years                                     | 65.04 (10.4)                          | 63.85 (10.05)                              | 1.01  | 0.97 – 1.05  | 0.55 |
| Sex, No. (%)  | 22 (78.6)                             | 331 (84.2)                                 | 1.46  | 0.57 – 3.74  | 0.44 |
| - Male  | 6 (21.4)                              | 62 (15.8)                                  |       |              |      |
| - Female  |                                       |  |       |              |      |
| History of cigarette smoking, No (%)                      | 9 (32.1)                              | 68 (17.3)                                  | 2.26  | 0.98 – 5.22  | 0.06 |
| Productive cough, No. (%)                                 | 14 (50.0)                             | 33 (8.4)                                   | 10.91 | 4.80 – 24.82 | 0.01 |
| History of COPD, (FEV1 < 75%predicted or medication used) | 6 (42.4)                              | 29 (7.4)                                   | 3.42  | 1.29 – 9.11  | 0.01 |
| Diabetes Mellitus, on medication                          | 9 (32.1)                              | 55 (14.0)                                  | 2.91  | 1.25 – 6.76  | 0.01 |
| Decreased Lung functions, No. (%)                         |                                       |  |       |              |      |
| - FEV <sub>1</sub> < 80%pred. and                         |                                       |  |       |              |      |

PRUH IDOVH SRVLWLYHV IURP WR GXH WR WKH VWULFWHU GHILQLWLRQ RI 33& +RZHYHU WKLV ULVH ZDV DFFRPSDQLHG E\ D VXEVDQWLDO UHGFWLRQ LQ WKH QXPEHU RI IDOVH QHJDWLYHV IURP WR LQ WKH YDOLGDWLRQ VWXG\

|   | Pneumonia | No Pneumonia |     |
|---|-----------|--------------|-----|
| <b>High Risk Pulmonary</b>  | 24        | 203          | 227 |
| <b>Low Risk Pulmonary</b>   | 4         | 190          | 194 |
|   | 28        | 393          | 421 |
| Sensitivity = 0.86, Specificity = 0.48, Positive predictive value = 0.11, Negative predictive value = 0.98. |           |              |     |

7DEOH HODWLRQ EHWZHHQ UHVXOWV RI WKH SUHRSHUDWLYH ULVN PRGHO DQG GLDJQRVLV RI SQHXPRQLD LQ SDWLHQWV

)LJXUH D SORWV WKH UHFHLYHU RSHUDWLQJ FKDUDFWHULVWLFV 52& FXUYH R

6LPSOLILFDWLRQ RI WKH VL[ IDFWRU ULVN PRGHO WR D IRXU IDFWRU ULVN  
PRGHO RQO\ LQFOXGLQJ WKH DQDPQHVVWLF LWHPV KDG D PLQLPXP LPSDFW  
RQ PRGHO DFFXUDF\ 7KH \$8& RI WKH IRXU IDFWRU PRGHO ZDV DQG  
LWV 139 ZDV 7KHVH UHVXOWV VXJJHVW WKDW WKH VL[ IDFWRU ULVN PRGHO  
FDQ EH VLPSOLILHG WR D IRXU IDFWRU ULVN PRGHO ZLWK DJH! \HDU  
SURGXFWLYH FRXJKLQJ VPRNLQJ DQG GLDEHWHV PHOOLWXV DV ULVN IDFWRUV  
ZLWKRXW D ORVV RI DFFXUDF\

:KDW LV DOUHDG\ NQRZQ IURP WKH OLWHUDWXUH RI SUHGLFWLRQ PRGOV"  
OLWFKHOO HW DO > @ SUHVHQWHG D ORJLVWLF PRGHO WR SUHGLFW 33&V WK  
LQFOXGHG YDULDEOHV VXFK DV SUHRSHUDWLYH VSXWXP SURGXFWLRQ LQ  
FRPELQDWLRQ ZLWK SRVWRSHUDWLYH QDVRJQDVWULF LQWXEDWLRQ DQG ORQJH  
DQHVWKHVLD GXUDWLRQ \$OWKRJK WKLW PRGHO KDG DQ DFFXUDF\ RI LQ  
SUHGLFWLRQ 33&V LW FDQQRW EH XVHG IRU SUHRSHUDWLYH ULVN VHOHFWLRQ  
&DUUHO HW DO > @ IRXQG WKDW WKH IUHTXHQF\ RI DEQRUPDO SUHRSHUDWLYH

\*RJEDVKLDQ \$ 6HGUDNIDQ \$ 7UHDVXUH 7 (XUR6&25( D