

% R Z H O (Q G R P H W U L R V L V \$ Q 2 Y H U Y L H Z

\$EXDLXE ORKDPPHG ORKLXGGLQ &KRZGKXU\ =KXR <XH
'HSDUWPHQW RI 'LJHVWLH 'LVHDVH 6FKRRO RI OHGLFLQH -LDPXVL 8QLYHUVLW\ -LDPXVL &KLQD
&RUUHVSQRQGLQJE\XMDKRB ORKDPPHG ORKLXGGLQ &KRZGKXU\ 'HSDUWPHQW RI 'LJHVWLH 'LVHDVH 7KH
OHGLFLQH -LDPXVL 8QLYHUVLW\ -LDPXVL(RKLQDG\HOP RKLXGGLQFK\#\DKRR FRP
5HFHLYHG GDWH 0DU \$FFHSWHG GDWH 0D\ 3XEOLVKHG GDWH 0D\
&RS\ULJKW &KRZGKXU\ \$700 HW DO 7KLV LV DQ RSHQ DFFHVV DUWLFOH GLVWULEXWHG XQGHU WKH WH
XQUHVWULFWHG XVH GLVWULEXLRQ DQG UHSURGXFWLRQ LQ DQ\ PHGLXP SURYLGHG WKH RULJLQDO D

\$EVWUDFW

(QGRPHWULRGHUVQHG DV WKH SUHVHQFH RI HFWRSLF HQGRPHWULDO JODQG RU V
:KHQ HQGRPHWULRVLV LQYROYHV RUJDQV RXWVLGH WKH SHOYLV LV FKDUDFWH
LQYROYHPHQW ZLWK HQGRPHWULRVLV LV QRWD FRPPRQ RFFXUUHQFH EXW ZKHQ
LQIODPPDWLRQ DQG VRPHWLPH ORFDO QHRSODVWLFRQGLWLRQV ZKLFK DUH UDUI
WKDW KDYH EHHQ GLVFXVVHG LQ WKLV OLWHUDWXUH 7KRXJK LW LV D EHQLJQ
KDV FHWDLQ JDVWURHQWHURORJLFDO PDQLIHVWDWLRQV WKDW DUH FRPPRQO\ ZKLFK PLVOHDGV RU GHODIV WKH SURSHU GLDJQRVLV DQG OHQJWKHQV WKH VXIIH



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HQGRPHWULDO J@ QGSXSDIBS@LQVWKHWHUPLQDO
LOHXP

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VXE PXFDQ\ PXFRVD)LJXUH 7KH LPSODQWV RI WKH HQGRPHWULDO
VWURDPUDH XVXDOO\ IRXQG LQ WKH DQWL PHVHQWHLF HGJH RI WKH ERZHO
:KLOH PLFURVFRSLFDOO\ WKWMURDQHRRHHWQLWQ JODQGV
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PLFURVFRSLF IRFL WR ODUJH VSDFH RFFXS\LQJ OHVLRQV LQYDGLQJ WKH ERZHO
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VWHQRVLV PD\ EH SURGXFHG E\ VPRRWK PXVFOH K\SHUSODVLD DQG ILEURVLV
VXUURXQ GHLOQGRWIKWQURLQXQH LQ FDVH RI ODUJHU OHVLRQV

XOWUDVRQRJUDSK\ LW DOVR PD\ GHWHFW WKH GHSWK RI LQILOWUDWLRQ RI WI
QRGXOH LQ WKH LQWLQJ\ DZDVO\ J\ LQD
XOWUDVRQRJUDSK\ DIWHU D SURSHU ERZI
FRQWUDVW WR WKH UHFHWXP PD\ IDFLO
FKDUDFWHULVWLHQGRPHWULQDO DRUI OH
5HFWDO HQGRVFRSLF XOWUDVRQRJUDSK\
GLDJQRVLV RI LQWHVWLQDO HQGRPHWUL
HVWLPDWLRQ RI WKH SUHFLVH GHSWK RI I
LQ WKH LQWHVWLQDO ZDOO WKH PD[L]PXF
GLVWDQFH RI WKH OHVLRQV IURP WKH DQX

ZDWHU
RQ DQG
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WR
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DQG WK



)LJXUH O'&7 H WKH BQGRPHWLRQ WO BIQ
LQILOWUDWLQJ WKH LOHXP

)LJXUH O'&7 H FRURQ(DQG RUPHFWQRQH WO XF
LQILOWUDWLQJ\ WKBRI\ WKH VLJPRLG VKR
DUURZKHDGV WKH PXFRVD LV QRW LQILC



OXOWLGHFWRBSWWHUL]HGHQWPRJOFDSWHLV
FDQ LGHQWLII WKH SUHVHQFH RI HQGRPHW
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RXWOLQH WKH LQILOWUDWLQ RI WKH HQ
)LJXUH OXOWLOD\HUHG VWUDWLILFDWL
REVHUYHU P\K\H\QX\Q\H\LSV\WDLQILOWUDWHG
3UHVHQF\H\RGHDQMHU EH WZHQQ W\K\NFOXOPHUQ\
SURSUQBLFDWH WKH IXOO WKLFNQHV LQ
LQYROY\Q\EPX\K\DRQ\W WKH PX\CR\B\H RI LRGLC
FRQWUDVW PHGLXP DQG LRQL]LQJ UDGLDWLRQV LV WKH PDMRU GLVDGYDQWDJH F
O'&7 H > @

OXDWH W
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HO ZDOO
D ZDOO
)LJXUH RORQRVFRS\ VKRZLQJ IRFDO PXFR
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(QGRVFRSLF GLDJQRVLV RI LQWHVWLQDO

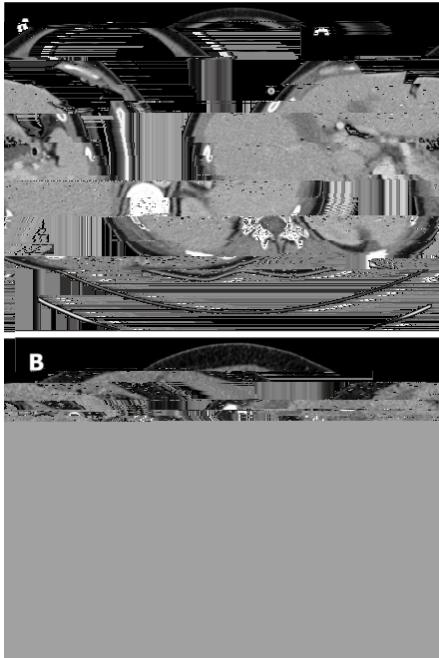
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KHWHRURWSLDV LQ WKH FRORQLF PXFRVD SUHVHQFH RI XOFHUDWLRQ LQ WKH PXFRVDQ PHPEUHDQGR P\QVSLRWWLFFWJLRRQ GDQOG
PXFRVD > @

, QWHVWLQDO REVWUXFWLRQ

3DUWLDO RI FRPSOHWH LQWHVWLQDO REVWUXFWLRQ FDQ EH SURGXFHG E\ HQGRPHWULRVLV E\ YDULRXV PDQLIHVVWDWLRQV OLNH DQJXODWLRQ RI WKH ERZO ORFDOL]HG HQGRPHWULRVLV FDXVLQJ SUHVvxUH RYHU WKH OXPHQ LQWHUUXSWL WKH IORZ RU FDXVLQJ LQWXXVVFHSWLRQV &RPPRQO\ REVHUYHG SKHQRPHQD LV VWHQRVLV RI ERZO OXPHQ)LJXUH FDXVHG E\ VPRRWK PXVFOH K\SHUSODVLD DQG ILEURVLV E\ EHQLJQ HFWRSLF JODQGXODU WLVVXH DQG ORFDOL]HG UHSHDWHG LQIODPPDWLRQ RI WKH ERZO ZDOO GXH WR F\FOLFDO KHPRUUKDJH > @ &DVH UHSRUWHG E\ 8QDOS +5 VKRZV DFXWH LQWHVWLQDO REVWUXFWLRQ WR D LOHIDQGRPHGWODB\LG/XH\WRWRORJ\ UHYHDOV HQGRPHWULRVLV ZLWK DQQXODU VWULFWXUH VKRZHG IRFL RI HFWRSI JODQGXODU WLVVXH ZKHUH ODSDURWRP\ HYDOXDWHG DQ XOFHUDWHG HGHPDW DQG IUDJLOH VHJPHQWLQDQ RYHDO\DE@YH&DWKHH UHSRUW\GK\VP\G\N\ULEHV WZR IUHH FRQVWULFWLQJ PDVV LQ WKH VLJPRLG FRORQ WHQYRWDQDQHWRKH WKH OXPHQ FDXVLQJ V\PSWRPV WR D \HDU ROG ODG\ ZLWK \HDUV RI NQRZQ KLVWRU\ RI HQGRPHWULRVLV

)LJXUM\%DULXP VWXG\ VKRZLQJ FRQVWDQW QDUURZLQJ DUURZ KHDG LQ WKH VLJPRLG FRORQ

3UHVHQWHG ZLWK F\FOLFDO KLVWRU\ RI IUHVK EULJKW UHG EOHHGLQJ SHU UFHWXP ZLWK DEGRPLQDQ VSFKUQDOR\QRAE\W\HG ZLWK UHYHDOV VWULFWXUH LQ WKH VLJPRLG FRORQ DQG EDULXP VWXG\ VKRZHG DUHD FRQVWDQW QDUURZLQJ DW WKH VLJPRLG FRORQ



B

)LJXUH \$[LDO FRPSXWHG WRRPRJUDSK\ &7 VFD
DEGRPLQDO FDYLW\ % 3HOYLF DEVFHVV DW WKH
XWHUXV

LQ WKH
RI WKH HQODUJH

(QGRPHWULRVLV LQYROYLQJ WKH DSSHQC



)LJXUH(QGRPHWULDO JODQGV DUURZ KHDG DQG VWURPDO FHOOV
DUURZ HPEHGGHG ZLWKLQ WKH PXVFXODULV SURSULD RI WKH DSSHQGL[

)LJXUHURVV DSSHUDUDQFH RI FURKQdV LOI

, QIODPPDWRU\ %RZO 'LVHDVH

\$ VWXG\ UHSRUW SXEOLVKHG E\ 7LQH -HVV RQ XQVHOHFWHG QDWLRQZLGH
'DQLVK FRKRUW RI ZRPHQ KRVSLWDOL]HG ZLWK HQGRPHWULRVLV
GXULQJ a VKRZV WKDW WKH ULVN RI ,%' LQ ZRPHQ ZLWK
HQGRPHWULRVLV ZDV LQFUHDVHG HYHQ LQ WKH ORQJ WHUP KHQFH VXJJHVWLQJ
JHQXLQH DVVRFLDWLRQ EHWZHHQ WKH GLVHDVHV :RPHQ ZLWK HQGRPHWULRVLV
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6WDQGDUGL]HG ,QFLGHQFH 5DWLR &, WR DQG RI

8OFHUDWLYH &ROLWLV 6WDQGDUGL]HG ,
DQG &URKQdV 'LVHDVH 6WDQGDUGL]HG
WR VHSDUB\W\H\O\DIM\H\U\QD GLDJQRVLY
8OFHUDWLYH &ROLWLV 6WDQGDUGL]HG ,
&URKQdV 'LVHDVH 6WDQGDUGL]HG ,QF
5HVWULFWLQJ DQDO\VHV WR ZRPH
HQGRPHWULRVLV VXJJHVWHG HYHQ VWURQ
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6WDQGDUGL]HG ,QFLGHQFH 5DWLR

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XQFRPPRQ > @ + RZHYHU PDOLJQDQW WUDQVIRUPDWLRQ RI WKH LQWHVWLQDO
WUDFW QRW EHHQ UHSR\$QVHHGRDNQIRUHVITXHVWUORJHQ@V
WKH ZLGHO\ DFFHSWHG IDFWRU IRU WKH GHYHORSPHQW RI SUHPDOLJQDQW RU
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FDUFLQRPD LV D FRPPRQ KLVWRORJLF WSH FRQIXVH ZLWK FRORUHFWD
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> @ 7KH FRORQ FDUFLQRPD FDQ EH GLIIHUHQWLWDHG IURP WKH
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%LVF(DQGLUHUR 6)XOKHUL (5DJQL 1 5HPRUJLGD 9 HW DO
0XOWL VOLFH &7 HQWHURFO\VLV LQ WKH GLDJQRVLV RI ERZHO HQGRPHWULRVLV (XU
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%LVFD OGL ()HUUHUR 6 5HPRUJLGD 9 5ROODQGL *\$ %RZHO
HQGRPHWULRVLV &7 HQWHURFO\VLV \$EGRP ,PDJLQJ
%D]RW 0 0DO]\ 3 &RUWH] \$ 5RVHDX * \$PRX\DO 3 HW DO
\$FFXUDF\ RI WUDQVYDJLQDO VRQRJUDSK\ DQG UHFWDO HQGRVFRSLF VRQRJUDSK\
LQ WKH GLDJQRVLV RI GHHS LQILOWUDWLQJ HQGRPHWULRVLV 8OWUDVRXQG 2EVWHW
*\QHFRO
3LNHWW\ 0 &KRSLQ 1 'RXVVHW % 0LOOLVFKHU %HOODLVFKH \$(5RVHDX * HW
DO 3UHRSHUDWLYH ZRUN XS IRU SDWLHQWV ZLWK GHHSO\ LQILOWUDWLQJ
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OLQH LPDJLQJ H[DPLQDWLRQ +XP 5HSURG
+XGHOLVW * 7XWWOLHV) 5DXWHU * 3XFKHU 6 .HFNVWHLQ - &DQ
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*RQFDOYHV 02 3RGJDHF 6 'LDV -\$ -U *RQ]DOH] 0 \$EUDR 06
7UDQVYDJLQDO XOWUDVRQRJUDSK\ ZLWK ERZHO SUHSDUDWLQ LV DEOH WR SUHGLFW
WKH QXPEHU RI OHVLRQV DQG UHFWRLJPRLG OD\HUV DIIHFWHG LQ FDVHV RI GHHS
HQGRPHWULRVLV GHILQLQJ VXUJLFDO VWUDWHJ\ +XP 5HSURG
0HQDGD 09 5HPRUJLGD 9 \$EEDPRQWH /+)XOKHUL (5DJQL 1 HW DO
7UDQVYDJLQDO XOWUDVRQRJUDSK\ FRPELQHG ZLWK ZDWHU FRQWUDVW LQ
WKH UHFWXP LQ WKH GLDJQRVLV RI FQGLDJQRVL „WXO`|pPÀ0 `0XO`|pPÀ0 `0HW Ÿ„Q @
` pP@`p@,}VW LQ
WKH UHFWXP LQ WKH GLDJQRVLV RI 5VLV ÅWV 0H00 €đ0) XpRPVP @ DD\€0 yPUDPNcKÝ +0 €